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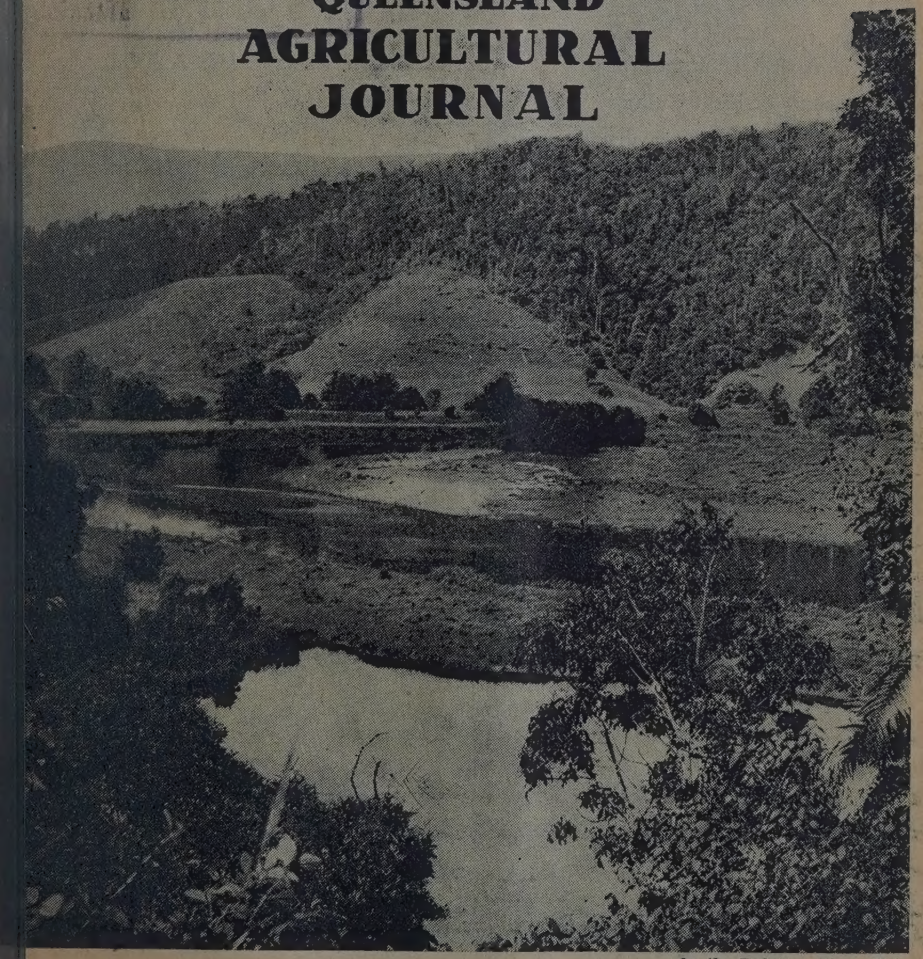

On the Daintree River, N.Q.

LEADING FEATURES

Native Pasture Legumes
The Value of Strip Cropping with Cotton
Passion Fruit Growing
Soft Rot Disease of Pineapples
The Cleaning of Dairy Utensils
How to Make a Pig Net

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Volume 60 Part 1

QUEENSLAND AGRICULTURAL JOURNAL

Edited by
J. F. F. REID
Associate Editor
C. W. WINDERS, B.Sc.Agr.

JANUARY, 1945

Issued by Direction of
THE HONOURABLE T. L. WILLIAMS
MINISTER FOR AGRICULTURE AND STOCK

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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

Food Needs in the New Year.

IN his New Year message in this issue, the Minister for Agriculture and Stock, Hon. T. L. Williams, stresses the fact that food production will be of even more importance in the coming year than it was in 1944. Apart from increased supplies necessary for the war in the Pacific, our obligation to the people of Britain still stands. As has been emphasised so often, food is a vital war material. The most critical year of the war will, probably, be 1945; a position of armed advantage has already been attained, but greater production of food is needed urgently to back the attack. Although made difficult by a seasonal setback and a shortage of farming requirements, the maintenance of adequate food supplies remains for us an essential task. The individual farmer, by the judgment which the experience of years has developed in his knowledge of every acre of his own farm, in his constant contest with the weather and with pests and diseases and other circumstances peculiar to the land industries, may be depended upon to go the limit in applying his own production plans. As with other industries, farm output can be increased by doing everything a little bit better, saving time and power here and there, getting the best out of every acre cultivated, turning off another fat beast and making conditions right for a bigger milk yield. To ensure the success of the 1945 food production campaign sustained teamwork will be necessary and, as Mr. Williams states, in discharging their responsibilities primary producers may count on the continued co-operation of the Department of Agriculture and Stock.

THE MINISTER'S NEW YEAR MESSAGE

★

WE enter a new year strengthened by recent experiences in our belief that a stable and well-organised rural industry remains the basis of both national security and national prosperity.

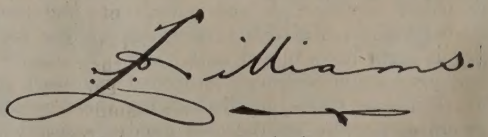
In that belief, I must express my personal gratitude to the primary producers of Queensland who have responded so well to the urgent call for increased production. To the country women, too, a special tribute is due for the splendid contribution they have made in national service.

During the past year, farmers have had to face grave disabilities, seasonal and otherwise, in maintaining and, where conditions have allowed, increasing their output. Because of wartime urgency, food production in 1945 will be even more important than it was in 1944. In discharging their responsibilities, farmers and graziers may count on the continued co-operation and willing service of the Department of Agriculture and Stock. In this, as in all our undertakings, good team work is essential; anything less would be a reflection on our commonsense and unworthy of the real Australian spirit manifested so well by the men and women of our Armed Forces.

I here record my sincere appreciation of the good will and valuable help extended to me, and to the officers of the Department which I administer, by the rural industries in the State. During the past year, we have shared the responsibility of maintaining supplies of essential foodstuffs to meet an ever increasing demand.

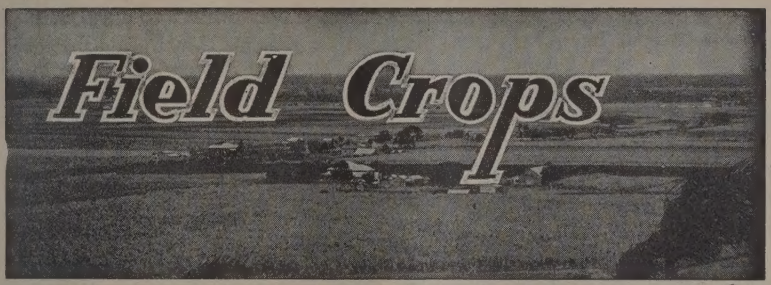
My New Year message to you all is: Study carefully the problems which affect your industry and continue doing your utmost to supply the food needs of the United Nations, which grow greater as the battle fronts extend. You, too, are "on active service" and your work helps to bring the day of victory nearer. May that day dawn in 1945!

To you all and to your families I wish once more an early re-union with those now absent, health and happiness in your homes and security in a peaceful future bright with opportunity and achievement.



Secretary for Agriculture and Stock.

1st January, 1945.



Native Pasture Legumes on the Central Coast.

O. L. HASSELL, Senior Instructor in Agriculture.

THROUGHOUT the dairying and other grazing districts of the Central coastal area there is need for the establishment and stimulation of pasture legumes. Many of the pastures sown to introduced grasses, particularly Rhodes grass, have deteriorated to a considerable extent and would certainly benefit from the introduction of suitable legumes. The native pastures, similarly, would be greatly improved if legumes could be maintained in them permanently.

The beneficial effects of clover and other legumes in temperate pastures are well known. They contribute to the feeding value of the pasture by providing green stuff rich in protein. Further, they have associated with them, in their roots, certain bacteria which have the power of securing nitrogen from the air in the soil and transforming this nitrogen into plant food, which is released to the plants and to the soil. The presence of these bacteria is indicated by the occurrence of swellings on the roots, but it is not always certain that the correct bacteria for each legume are present in the soil, and consequently it is advisable to inoculate the seed with the bacteria prior to sowing.

In many of the warmer and drier parts of Queensland introduced legumes cannot be established and maintained in either native or sown pastures. There are, however, numerous representatives of the legume family indigenous to the native pastures, though usually the grazing management is such that these do not persist in any great quantity in the pastures.

The Department of Agriculture and Stock has for many years been interested in the utilization of native legumes for pasture improvement purposes, and in 1940 extended its trials to the Mount Larcom and The Caves areas, where Rhodes grass pastures sown on softwood scrub country had become seriously infested with weeds and much reduced in carrying capacity.

Descriptions of Legumes.

The legumes selected for trial work on the Central coast were either native to or naturalised in that area. Many of them have a wide distribution in the State. The following brief descriptions, together with the illustrations, should aid farmers and graziers to recognise the various species and to appreciate the part which each might play in improving pastures.

Alysicarpus buplurifolius.—A slender, erect-growing plant, with a number of branches from the base, which occurs in both coastal and inland areas. It seldom grows higher than 18 inches, and prefers ridgy or well-drained positions. Cattle are fond of it and it should be a useful addition to any pasture.

Alysicarpus rugosus.—A semi-erect plant with numerous branches from the base. It seldom grows higher than 18 inches. When the seeds are mature the plant is inclined to be woody, but stock eat it readily when it is young. It occurs inland, as well as on the coast.

Alysicarpus vaginalis.—A low, branching and spreading perennial plant, attractive to stock, and very often found on the coast in damp situations. It would be an asset in any pasture.

Plate 1.
Alysicarpus buplurifolius.

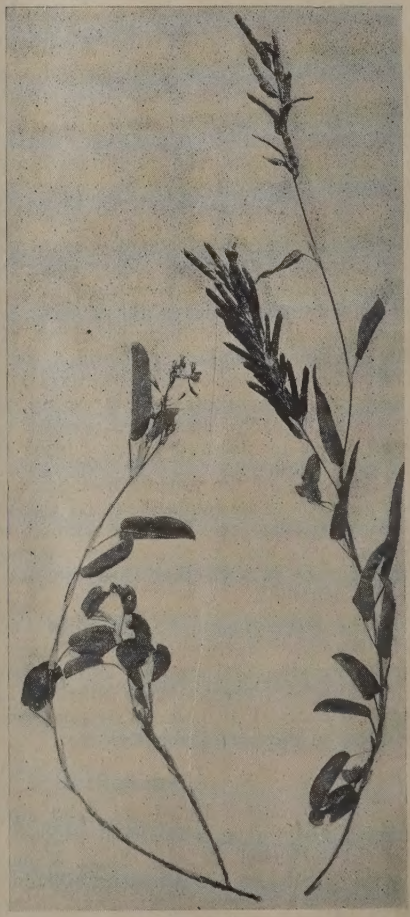


Plate 2.
Alysicarpus vaginalis.

Cassia absus.—A bushy, erect-growing plant, usually about 18 inches high. It has small yellow flowers, and flat seed pods about 1½ inches long. Although this legume will grow on various types of soil, it is usually found growing on hard stony or clayey ridges. Cattle will not eat it unless forced to.

Cassia mimosoides.—A slender, erect-growing plant, with a single stem, which seldom grows more than 3 feet high. It is usually found in damp, low-lying places or swamps, and in cultivations on heavy soils. It has small yellow flowers and flat seed pods, from 1½ to 2 inches long. In the Central district this plant usually appears with the storms in November or December. Cattle do not appear to be particularly fond of this legume, but will eat the top portion up to about flowering stage.

Cassia sophera (Yellow pea).—An erect-growing, shrubby plant about 2 feet high, which bears yellow flowers. It grows in both the coastal and inland areas of the Central district, usually on hard ridges. Cattle seldom eat it, except when forced to.

Plate 3.
Clitoria ternata.

Clitoria ternata (Butterfly pea).—A strong-growing bushy creeper, with large dark-blue flowers. It is sometimes used as a garden plant, and when in flower makes a good show over a bush-house or trellis. It is a perennial and will last for a number of years in pastures, although kept grazed down. Cattle are particularly fond of it. The plant can become very troublesome in cultivations, being difficult to eradicate on account of its deep-rooting habit and heavy seeding. This plant is worth encouraging amongst pastures.

Crotalaria striata (Rattlepod).—A bushy-growing annual, which will grow to about 2 feet high. It has rather attractive, light-yellow flowers, and can be found in most parts of the Central district. It usually grows on ridges or well-drained soil. This plant is considered to be poisonous to stock.

Desmodium brachypodium.—An erect-growing plant with long tendrils. The leaves are longer than those of most of the native legumes. It is often found on hard, stony ridges. Cattle will eat it, although they are not particularly fond of it.

Plate 4.
Glycine clandestina.

Desmodium muelleri.—A very slender-growing, branching creeper, with numerous runners or tentacles. It has a small purple flower and flat seed pods, about ½ an inch long, with a depression in the pod between each seed. This species usually grows on heavy clay flats, and usually nodulates heavily.

Desmodium polycarpum.—An erect-growing, slightly branching plant, which usually grows about 2 feet high, with small purple flowers and narrow, flat, dark-brown seed pods, bunched at the end of the stalks. These seeds are a bright yellow colour, and about the size of lucerne seed. Cattle will eat it, although they are not particularly fond of it.

Desmodium varians.—A short, slender, erect-growing plant, with numerous shoots direct from the base. It usually grows on hard ridgy country. Although it would be an asset in any pasture as a legume, it would not be of any great value as a fodder on account of its short, slender growth.

Glycine clandestina (Twining Glycine).—A very slender-growing creeper, with long, thin, twining runners. It has small purple flowers, with narrow seed pods, about 1 inch long, and is usually found growing on sandy ridges. Stock appear to be fond of it, and it would make a useful addition to any pasture.

Glycine tabacina (Glycine pea).—A strong-growing, creeping annual with very long runners, found growing in most of the coastal areas and certain inland parts of the State. It does particularly well on sandy country, and should be useful in helping to hold grass on this type of country. Cattle will eat it. This species is not recorded as poisonous to stock.

Glycine tabacina (A narrow-leaf form of Glycine pea).—A slender, narrow-leaf form, having a semi-twining habit. It grows on the coast, as well as part of the inland areas. This plant prefers the heavier types of well-drained soils. Stock are fond of it.

Glycine tabacina (A hairy form of Glycine pea).—A semi-creeping type, with shorter and rounder leaves than the ordinary form. The leaves are covered with short, white hairs, which give them a soft, velvety feeling. It prefers heavy country, and is known in the Central district as Dawson Valley lucerne. Stock are very fond of it.

Indigofera enneaphylla.—A very low-growing and branching perennial, with red flowers. It can be found growing on various types of soil in the Central district, both on the coast and inland. Although there is very little leafy growth on this plant, cattle eat it readily, especially when carrying seed.

Indigofera glandulosa.—An erect-growing, single-stemmed annual, which seldom grows more than 2 feet high. The small, rough-coated seed pods are spread along the full length of the stem. It is usually found growing on heavy soils in the coastal and inland areas. This plant generally carries a heavy crop of root nodules. It cannot be looked upon as much value for stock feed, on account of its sparse growth.

Indigofera hirsuta (Hairy indigo).—This is found in most of the coastal areas of the State. It is an erect, branching plant, having small red flowers and seed pods covered with short, brown hairs, which give

them a velvety feeling. It is an annual, and grows best on loose or sandy soils, but is very often found on hard, stony, forest ridges. It is looked upon by some graziers as a good fodder and is sometimes called Paddy's lucerne. It has, however, been suspected of poisoning stock.

Indigofera linifolia.—A very fine or narrow-leaved annual, which branches and grows very close to the ground. It has dark-red flowers, which are followed by clusters of small round, white seed pods. Although the plant does not grow more than a few inches above the ground, stock will eat every available portion when it is in seed. This plant should make good sheep feed.

Indigofera tinctoria.—A very woody and bushy annual, which at times can be found growing as high as 4 feet. It has numerous bunches of deep-red flowers and long, thin seed pods, which are shaped like a half-moon. This species is a very strong-growing plant, and will hold its own against most grasses. Cattle will seldom eat it, unless forced to in overgrazed paddocks. *I. tinctoria* is usually found growing in

Plate 5.
Indigofera linifolia.

well-drained situations, and is well established in the coastal areas of the Central district. It is one of the original sources of commercial indigo.

Indigofera trifoliata.—A very slender, erect-growing plant, which seldom grows more than 18 inches high. It usually carries a heavy supply of root nodules. It is a heavy seeder, with the seed pods spread along the full length of the stem. It will grow on numerous types of soil and is considered to be a palatable and useful fodder.

Indigofera viscosa (Sticky indigo).—A very slender, semi-erect, heavy-seeding plant, which seldom grows higher than 1 foot. It grows usually on sandy flats or hard, well-drained ridges. It is generally avoided by stock, unless on overstocked country. The leaves and stem when crushed have a peculiar scent, which may cause taint in milk.

Lotus australis (Native bird's foot trefoil or brown lucerne).—This is very often found growing on well-drained ridges. It is considered poisonous to stock at certain stages of its growth, due to the formation of a prussic-acid yielding glucoside. Stock are very fond of it.

Plate 6.
Rhynchosia minima.

Phaseolus lathyroides (Phasemy bean).—An imported, erect-growing, slightly branching plant. It has large, dark-red flowers and a narrow, round seed pod, about 2 inches long. *P. lathyroides* can be found growing in most of the coastal districts of Queensland. Stock do not take to it readily, but eventually become very fond of it. In the Central district, some farmers use it as hay, in conjunction with grass, and also feed it green to pigs. In pasture rejuvenation trials undertaken by the Department of Agriculture in the Central district this legume was found to stand up to grazing for about two years. This plant nodulates heavily, is a free seeder and should play a prominent part in the rejuvenation of coastal pastures.

Rhynchosia minima.—A very strong-growing, creeping perennial, found usually on black-soil flats. It has a small, bright-yellow flower, which usually appears in October or November, but often much later, according to the rainfall. It drops its leaves in the early part of the winter. When young it is readily eaten by stock, but when mature becomes rather fibrous and coarse. It is sometimes looked upon as a pest in cultivations.

Sesbania aculeata (Sesbania pea or Gulf pea).—A tall-growing, branching plant, which, under ideal conditions, will grow as high as 9 feet. It is usually found growing in damp situations and on heavy soils. It grows well on heavy black soils of the coast and inland areas. It is looked upon as a pest in certain areas, such as the Callide and Dawson Valleys, where it is a nuisance amongst wheat and sorghum crops. *S. aculeata* is a very heavy nodulator, and is used in India extensively as a green manure crop. It should be well worth a trial for the same purpose in this country.

Establishment in Pastures.

Seed of all promising native legumes found growing in the Central district was gathered during 1940 with a view to testing their value in restoring pastures to their original carrying capacity.

Renovation work was limited to harrowing, as the rough, stony nature of much of the country in the area selected for trials will not permit of renovation by plough or cultivator. The trial area was securely fenced against stock and, after grazing and harrowing, seed of the various legumes was broadcast at the rate of 2 lb. per acre, amongst the failing Rhodes grass pasture. Stock were admitted to the trial areas for certain periods of the year.

Season 1941-42—

Plots measuring 8 chains by 1 chain were located with Messrs. G. Hatch, The Caves, and B. Taylor, Machine Creek, on land originally carrying softwood scrub. Thirteen species were planted in randomised strips, 12 feet wide, the three replications plus control plots giving a total of 42 plots. The pasture was heavily grazed down, harrowed before planting, and cross harrowed after planting.

As the paddock was closed for grazing, following sowing and harrowing, the Rhodes grass made a wonderful recovery and seeded heavily, but there was no apparent difference in the growth of grass on the control plots as compared with those on which the legumes had been planted. When the plots were grazed off, cattle appeared to prefer the *Phaseolus lathyroides*, and *Indigofera hirsuta*. Several of the native legumes did not germinate following the original dry sowing, or when sown later under ideal conditions.

Season 1942-43—

The plots were closed to stock during June, 1942; but, owing to dry conditions, growth was negligible from June to October. In November, after light storms and harrowing, *Phaseolus lathyroides* and *Indigofera tinctoria* were throwing out fresh shoots. All plots were resown in December under ideal conditions, when it was observed that only *P. lathyroides* and *I. tinctoria* gave a satisfactory germination. The poor germination was attributed to the soft seedbed, as under natural conditions most legumes germinate in a hard seedbed and have the native grasses as a protection from the sun, whereas in this trial the young Rhodes grass was only commencing growth when the native legume seed was sown.

P. lathyroides was again the outstanding species in germination, general growth, and ability to grow well amongst a thick sward of grass. *Rhynchosia minima, Glycine tabacina* and *Vigna luteola* threw out long runners and seeded heavily. The growth of *I. tinctoria* plants remaining from the previous season increased considerably and became very woody. The plots were grazed heavily for a month from late February, when it was found that stock readily ate *P. lathyroides, I. hirsuta, V. luteola,* and *Sesbania aculeata,* but showed no particular preference.

Scattered plants of *P. lathyroides* were noticed throughout the plot, as spread by stock, also a few plants of *R. minima.* Other species showed no sign of reseeding from the previous season's growth.

Season 1943-44—

Owing to pressure of food production duties, seed could not be gathered for a general sowing, and it was decided to sow *P. lathyroides* throughout the plots. Seed was therefore broadcast during December at the rate of 3 lb. per acre, without harrowing, thereby leaving the remaining legumes undisturbed. Although a good germination was obtained, the plants did not make high growth as the season was dry. There was also an increased growth of Rhodes grass following the heavy harrowing given during the two previous seasons. The only species remaining, apart from *P. lathyroides,* proved to be *I. tinctoria,* which had increased slightly, *G. tabacina* and *R. minima.*

Conclusion.

Although fresh seed was used during the second year of the trial, germination was very poor in all varieties, with the exception of *P. lathyroides* and *I. tinctoria,* both introduced species. Further trials on differing soil types would be necessary to discover the reason for the poor germination noted, although seasonal conditions are naturally an important factor.

It was found that *P. lathyroides* will seed under grazing conditions, and reseed the second year, but unless further sowings are made may almost totally disappear after the third year. This conclusion was borne out by planting seed over an area of 5 acres by Mr. B. Taylor, and of 10 acres by Mr. G. Hatch.

If seed of *P. lathyroides* can be produced at a reasonable price, this legume should prove useful for the rejuvenating of pastures with the aid of harrowing in the Central district, as it will remain in the pastures for at least two years. It could also be cut for hay with the natural pastures.

The Value of Strip Cropping.

W. A. COWDRY, Acting Manager, and R. W. GEORGE, Field Assistant,
Biloela Research Station.

WHEREVER land is of sufficient slope for rain water to flow over its unprotected surface, soil is washed away during each storm with a resultant impoverishment of the land. Large areas of the State are thus losing much of their surface soil by water erosion in its various forms. As it has been estimated by competent authorities that the surface soil is only replaced at the rate of one inch every century, the need to preserve that soil becomes apparent.

Besides the loss of soil, the loss of water through run-off is also important. Where crops are subject to periods of deficient soil moisture, caused either by a low total rainfall or irregular distribution of rainfall, practices which help to minimise this deficiency are of the utmost importance. Such practices should retard the run-off of storm waters, thereby increasing their penetration into the subsoils—thus providing a better supply of moisture for crop growth than where retardation of run-off waters is not achieved.

The use of the grassland-cotton rotation recommended by the Department of Agriculture and Stock greatly improves the permeability of the surface soils, thereby increasing the absorption of storm rains, investigations having demonstrated that little if any run-off of an inch storm occurs on a cultivation during the first year after grassland. In storms of greater intensity, or on older cultivations, much greater run-off occurs especially on areas planted to cultivated row crops, unless suitable preventive measures are employed.

One of the most efficient and economical methods of reducing run-off and soil loss on slopes of less than 4 per cent., i.e., a 4-foot drop in every 100 feet down slope, is strip cropping. This system of farming consists of planting a field to a series of alternating strips of a row-cultivated crop such as grain sorghum, cotton, or maize, with a crop which can be broadcast or sown with a combine or similar machine, such as Rhodes grass, lucerne, wheat, oats, or barley. These strips, which should not be over 100 feet wide on the lesser slopes, and about 50 feet wide on slopes around 4 per cent., should follow as nearly as possible the level contour across the slopes. By this means the strips of dense growing crop trap much of the rain as it falls and any excess water runs off slowly over the adjacent strips of row-cultivated crop. If the latter strips are of the recommended widths and the rows are approximately level across the slope, the rate of absorption of both the rain falling on the cultivation

and the slow-moving run-off water from the cover crop is sufficient to improve the moisture penetration into the subsoil of the cultivation. This is particularly true if proper rotation of crops to maintain a permeable surface soil is practised.

Under strip crop farming, rotations can be followed which will reduce run-off during the period of thunderstorm rains, which, in many years, is the start of the planting season. Frequently the whole of a long slope may be bare cultivated land awaiting planting rains, and if a severe storm is the first rain received, serious loss of soil occurs—in some instances most of the ploughed soil down to the plough sole. By having alternate strips of a cover crop that has grown through the winter and spring, run-off of such a storm is largely controlled and serious loss of soil is generally prevented—the alternate strips of cover crop reducing the flow of the storm waters sufficiently to prevent them cutting deeply into the ploughed soil.

Plate 7.
A Section of a Field of Cotton and Rhodes Grass Planted on the Strip Cropping Method.

The necessary width for each strip will vary according to the slope, soil type and rainfall likely to be experienced. It is not possible, therefore, to recommend any standard width, but farmers are advised not to make the strips over 100 feet wide, otherwise the advantage of the strip cropping will be largely negatived. The amount of fodder necessary to grow on each farm will also have to be considered in arriving at the best width for the strips. However, it is advisable to have the widths of the two kinds of strips—row crop and grass crop—approximately similar so that an interchange may be made when desirable without seriously affecting the general rotation procedure on the farm. A greater amount of conserved fodder is needed in this State, and the practice of strip cropping offers a means whereby better yields of good quality hay may be obtained and produced over a longer period.

In order to ascertain the merits of growing cotton by the strip cropping method, a small area was chosen for the purpose at the Biloela

Research Station, and a strip of Rhodes grass was planted on the contour across the field (Plate 7) in December, 1935. Cotton was sown annually thereafter parallel to the Rhodes grass, both above and below it. The slope was not great, but, because of the light texture of the soil and its tendency to set quickly, considerable loss of soil and water had occurred during previous years in which crops had been grown by the usual cultural methods. These had consisted of row and drilled crops, neither apparently doing much to stop the persistent loss of soil and water.

In 1939 the grass strip was ploughed and later planted to cotton, while two parallel strips on either side of the central strip were broadcast to Rhodes grass in February, 1940. This left a portion of old cultivation both above and below the two strips of Rhodes grass, which was planted to cotton once again for comparison with the centre strip after Rhodes grass. While this did not thoroughly test the merits of strip farming, it served as a comparison of the merits of planting cotton on the contour, following a plough-up of Rhodes grass, and following old cultivation in conjunction with strip cropping.

Because of the poor sandy type of soil, the yields were not great on any part of this test, but on a percentage basis over five seasons the mean gain in yield on the area following grass over the mean of the areas under continuous cotton was 116 per cent. This is very considerable, and when the data are considered season by season it would seem probable that the large gain in the first year was due to the increased moisture absorbed in the more permeable cultivation after grassland, while subsequent gains could be assigned to both the permeability of the country after being under Rhodes grass and the improved absorption of the slow moving run-off from the strips of Rhodes grass.

Data obtained on various occasions at the Research Station have shown that Rhodes grass definitely retards run-off and thus allows greater penetration of general rains and any storm rains over 1½ inches. For instance, it has been found that, several days after a storm rain, much greater quantities of moisture were available at 18 inches under growing Rhodes grass than in either bare fallowed land or in an adjacent cotton crop.

Although some washing of soil from the cultivated strips of the experiment did occur on a few occasions when rain fell at an excessive rate, the loss of soil, and more particularly water, was greatly reduced. This is perhaps more noteworthy when the type of soil is considered.

Particulars as to methods of surveying the contour lines for strip cropping can be obtained from the Department of Agriculture and Stock, Brisbane, or by contacting any of the field officers of the Department located in the main agricultural centres.

Summary.

Strip cropping can be practised with a wide variety of crops and soils on slopes of not over 4 per cent. drop at little extra cost or inconvenience as compared with the usual methods of farming. It definitely retards run-off of storm waters, thereby increasing the absorption of subsoil moisture and at the same time reducing the loss of valuable surface soil. The combination improves the productive power of the soil, which in turn means an increased return to the farmer. Strip cropping should therefore be adopted whenever practicable.

Passion Fruit Growing in Queensland.

H. BARNES, Director of Fruit Culture, and J. M. WILLS, Fruit Branch.

THERE is no reason why passion fruit growing should not develop into an industry of very considerable importance in Queensland. The vine is quite at home under the climatic conditions existing in this State, particularly in the sub-tropical coastal areas, where it makes vigorous growth and produces good crops. It is in constant demand as a fresh market commodity, and for inclusion in canned tropical fruit salads, fruit drinks and confectionery.

Though there are a number of varieties in existence in the State, only one—the purple-fruited *Passiflora edulis*—is grown commercially.

In some parts of Southern Queensland, hitherto regarded as essentially banana-growing and dairying districts, there is little virgin land left for banana-growing. Old plantations usually carry a good cover of grass, but at times, because of altitude and inaccessibility to dairy stock, they are unsuitable as grazing areas. On such areas, which otherwise may remain unutilised, the planting of passion fruit has proved payable.

The passion vine is a vigorous and adaptable plant, but it does not follow that because of this plantings may merely be made at random and the vines allowed to grow without care. On the contrary, considerable attention is necessary in order to obtain the best results, and disappointment is the usual result of "hit or miss" methods of cultivation.

The prospective grower is recommended to commence with a small area, which may be afterwards increased. Four to five acres of vines is, generally, the maximum area one man can cultivate and attend to, if horse-drawn or mechanically-driven cultivators are used, though more labour will be necessary for harvesting and packing. On less accessible sites, where hand-cultivation is the only practicable method, the area should be substantially less for efficient working; in such circumstances, two or three acres will be found quite large enough to occupy the full time of the grower.

Climatic Conditions.

The Queensland coastal climate, particularly in the south, is very suitable for passion fruit growing. The vine thrives under warm, humid conditions, such as prevail in the coastal area. Self-sown plants may commonly be found growing along the edges of rain forest clearings,

roads, and snigging tracks, where they establish themselves with remarkable ease, and produce fruit of quality and quantity in competition with natural vegetation.

Under normal seasonal conditions, heavy rainfall assures sufficient soil moisture for most of the year for the maintenance of vigorous growth, the exception being perhaps in early spring. Attention to cultivation will usually offset any ill effects of a dry spring, but where it is prolonged into a dry summer some defoliation and loss of fruit may be expected. Some growers have found passion fruit growing profitable enough to warrant the installation of an irrigation system.

In the south-eastern parts of Queensland, frosts occur on flat and low-lying land, but severe frosts are rare on hillside country. When deciding to grow passion fruit, this fact should be kept in view. Light frosts will do little harm to the vines, but a severe cold snap will kill the young top growth and may destroy the vines completely.

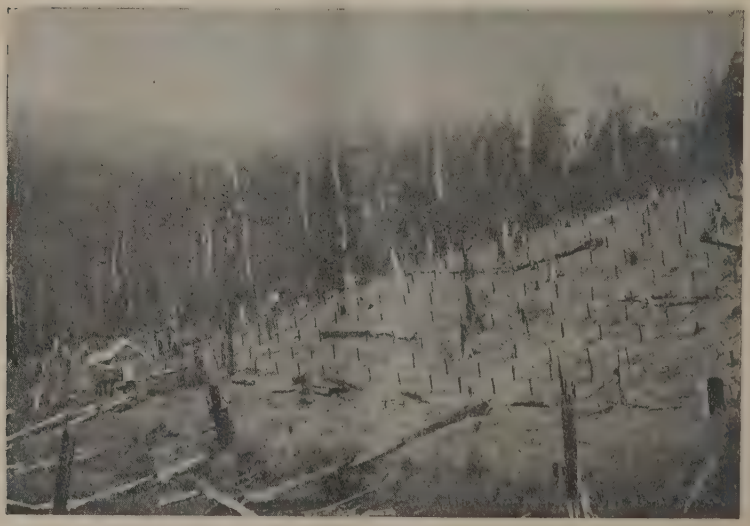


Plate 8.

A ONE-TIME BANANA PLANTATION TRELLISED FOR PASSION FRUIT VINES.

Cropping Habit.

Each crop is borne on new growth. The time which elapses between planting and first fruiting varies considerably, and depends chiefly on the time of planting and the strength and vigor of the vines. Vigorous plants commence to bear earlier than less robust ones, and may produce a few fruits at six months. As a general thing, however, vines planted in the early spring produce the first commercial crop in from twelve to fifteen months. When autumn planting is practised, a small crop may be borne the following summer or autumn, and the first big crop eighteen to twenty-one months after planting.

In favoured localities two crops are generally borne yearly—a main summer crop and a secondary winter crop. Approximately ten weeks elapse between the time of setting of the fruit to maturity. Blossoming occurs usually during August, September, and October for the summer crop, and during February and March for the winter crop. Marketing of the summer crop commences in October and may extend to January, with the heaviest pickings in November and December. The winter crop is usually harvested in May and June.

Plate 9.
A SIX-MONTHS OLD VINE SHOWING FIRST FRUIT.

More or less continuous growth occurs in some years when weather conditions are favourable, and this results in the production of flowers and fruit right through the year. Occasionally, definite intermediate crops are obtained. The most evident of these is harvested during the months of February and March, following a November and December

blossoming. These intermediate crops, although light, are usually very profitable, since they are marketed outside the periods of peak harvest. However, they are not normal, and are often followed by light settings of fruit for the main crops.

At high altitudes of 1,500 to 2,000 feet above sea level, flowering and cropping habits vary very widely on individual plantations, being influenced by the immediate local conditions. In general there is a main summer crop, which matures later than that on lower lands, with a subsequent winter crop; but on some plantations there is continuous cropping and flowering all the year round. This is influenced to some extent by pruning and consequent forcing of new growth on which the flowers are borne. Other areas, which are exposed to cold winds or lack sufficient sunlight during the winter months, bear exceptionally late crops. On still other sites, the crops are matured very early, even before those on the low lands. Growers planting on such locations are fortunate in being able to harvest their fruit during a period when the market is in short supply, and when prices are consequently considerably higher than those prevailing during the period of peak harvests.

Plate 10.

RISING GROUND ON ONE SIDE AND A SOLID BELT OF TIMBER PROVIDE GOOD PROTECTION FROM WINDS.

The profitable life of the vine is generally about four years when grown under proper cultural conditions. Maximum cropping is obtained with the second summer crop, following which the tendency is for the vines and the quality and appearance of the fruit to gradually deteriorate. Reasonably good crops may, however, still be obtained for another year or two.

Selection of Site for Plantation.

Six important factors should be considered in selecting a site for a passion fruit plantation, viz., aspect, elevation, shelter, soil, drainage, and accessibility.

Aspect, elevation, and shelter generally will go together, as a good aspect is often elevated above frost level and sheltered from heavy winds. The aspect for preference should be from east to north, open to the morning sun, and backed by rising ground or dense natural timber to protect it from westerly and southerly winds. An aspect from east to north is naturally warmer, and this fact has a marked influence on the early maturity of the vines and the production of large crops of high grade fruit which colour and ripen evenly and rapidly. The exposed tops of ridges should be avoided where the soil has washed: vines rarely do well when planted in such situations.

Plate 11.

An Established Passion Fruit Vineyard.—This vineyard is situated at Springbrook on one of the numerous small, richly fertile plateaux of the Macpherson Range, bordering New South Wales in the south-eastern sector of Queensland.

Vines are not very exacting in respect of choice of soils. Any which are reasonably fertile are usually quite suitable, but it is of the greatest importance that they be well drained. Stagnant water at the roots and sour soil conditions are fatal. Soils on which vines are at present growing successfully range from rich rain forest to light scrub and forest soils. In the case of the first-mentioned, vines have a tendency to produce very heavy rank foliage which becomes rather a disadvantage, in so far that extra work is entailed keeping the growth within reasonable bounds and checking fungus diseases to which the vine is subject. Good scrub and forest lands produce vines of good average growth without the tendency to excessive foliage, while there is little, if any, difference in cropping propensities. Normally, forest and scrub soils do not possess as great an amount of humus as those of rain forest origin, and after being cleared of the natural timber for two or three years it may be observed that they dry out rather too quickly. This can be rectified, and the ground made to absorb and hold moisture better, by growing and turning in cover crops during the winter. In

addition, the fertility and mechanical condition of the soil also will be improved.

In common with the banana, passion vines thrive on stony ground, and except that cultivation is made more difficult, the presence of surface stone is not undesirable. Moreover, it has the advantages that it minimises soil erosion on hillsides, and assists in the retention of soil moisture and the maintenance of a higher soil temperature during winter. It is obvious that the latter is important in maintaining the vigor of the plants and inducing an earlier response to spring conditions.

Plate 12.

PREPARING HILLSIDE LAND BY HAND FOR PASSION FRUIT.

Drainage.

Throughout the coastal districts in South Queensland there is a heavy yearly rainfall, but during normal wet seasons, half the annual fall may be precipitated during two or three months, hence the need for a well-drained soil.

Elevated and sloping sites are usually drained sufficiently, but drains across the slope, should be made at intervals to carry surface run-off and control soil washing. These cross or contour drains should be as short as conveniently possible to avoid the necessity for having to carry too much water, and should have but a very gradual fall into main drains provided at intervals. By keeping the surface of the soil well broken up, absorption of rain is increased and the possibility of erosion is lessened.

Accessibility.

The method of cultivation will be decided by the site selected. Mechanical or horse-drawn implements are, of course, more economical, but necessitate the thorough cleaning of the land in the first instance. The presence of logs, stumps, and stones makes hand cultivation necessary, with a corresponding increase in the time and labour required.

When elevated sites are selected, the provision of a "flying-fox" or overhead wiring system will be found a great convenience for the quick and safe transport of fruit to the packing shed, and for this reason a suitable site for a shed should be found or provided. Instructions for the erection of a wiring system may be obtained on application to the Department of Agriculture and Stock, Brisbane. Where possible, the packing shed should be conveniently situated alongside a good road providing access at all times to a railway siding. It should be borne in mind that daily despatch of fruit to market is desirable and that any disorganisation of or delay in transport may result in loss.

Preparation of the Land for Planting.

The land in which vines are to be planted should be well prepared in order that the young plants may establish themselves rapidly and develop a good root system which can traverse a greater area from which to draw available plant food. Where ploughing is possible, this should be well and deeply done, and the soil later worked down finely. On land which it is not possible to plough, the soil should be broken up with mattocks or steel pronged forks. Preparation should be completed by the end of August, so that any rain which falls will all be absorbed and the land will be in good condition for planting.

Coastal soils are known to be deficient in lime, and an application of from ½ ton to 1 ton per acre will assist in correcting acidity and generally improve the condition of the soil.

Plate 13.
A Young Passion Fruit Vineyard on Red-oak Soil at Mudgeeraba.

Mulching.

Paper mulch 18 inches wide is used in some localities when available to keep down weed growth around the young plants and under the trellises where mechanical or horse-drawn implements cannot be used and hand-chipping has to be done. The soil is prepared by forming

"lands," that is, the ploughing of at least four furrows towards the centre, and, after breaking down the soil finely, laying the paper on these, care being taken to cover the edges with soil to prevent the paper being lifted and torn by the wind. Holes are punched in the paper at the required distances apart, and the plants set through them. The young plants should be watered in, the planter being careful to see that the crown is well clear of the soil.

Planting Distances and Trellising.

Eight to 10 feet is usually allowed between rows, and 15 to 16 feet between plants. The number of plants required to the acre at the various distances are: 8 feet by 15 feet = 363 plants, 8 feet by 16 feet = 343 plants, 10 feet by 15 feet = 290 plants, and 10 feet by 16 feet = 270 plants. In general, the more fertile the land the greater should be the distance apart within the limits shown above.

Plate 14.
VERTICAL OR FENCE TYPE OF TRELLIS WITH THREE WIRES.

Nothing is to be gained by crowding the plants, which should be allowed room for a natural vigorous development and to permit of cultivation with implements where possible, without risking damage to the trellises even when wide spreaders are used on the horizontal type of trellis. Planting too close in the rows has little or no advantage, for after the first year the foliage of the vines will become too dense. It will then be necessary to cut out, possibly, half the number of vines in order to keep the foliage sufficiently open to admit light and allow for the free circulation of air throughout the vine. Also, it is necessary to permit dead leaves to fall clear to the ground, carrying with them perhaps fungus spores which would more readily infect other portions of the plant if allowed to remain caught up in a mass of foliage on the trellis.

For the proper development and ripening of the fruit sunshine and air should penetrate to all aerial parts of the vine, hence the advisability, wherever possible, for running the trellises in a north-south direction. The vines will then have an even distribution of sunlight over the whole of the growth on the trellis. On hillside plantations it is not always possible nor desirable to adhere to this rule, since factors such as the conservation of surface soil are all important. Less erosion is likely to follow where the vines are planted across the slopes and the soil hilled along the rows with cultivation. Any stones, unburnt logs, &c., should also be placed in the rows. Each row will thus eventually provide a surface drain which will carry off its share of excess water during periods of heavy rain.

In commercial vineyards, trellises are mainly of two types, the vertical and the horizontal. Both have advantages and disadvantages, but on the whole the horizontal is considered the more suitable. The outlay for wire, posts, and strainers and their erection is a factor which often influences the type of trellis to be erected. A vertical trellis is less costly, and therefore if posts and strainers have to be purchased, many growers erect this kind of trellis at first, and for later plantings use the horizontal type. Wherever it is possible for a grower to split and erect his own posts and strainers, a considerable saving will result. Usually there is plenty of suitable timber growing handy. Most of the natural hardwoods last longer than the passion vines, and may therefore be safely used, but if selection is possible posts should be split from bloodwood, ironbark, grey gum, or yellow stringy. These timbers will last for many years.

Substantial trellises only should be erected, because they must bear a heavy weight of vine and fruit. The top wire in whatever kind of trellis is built should be not less than 6 feet from the ground in order to permit plenty of room for fruit-bearing laterals and to allow them ample light and air.

In a horizontal trellis (Plate 16) the two wires are run side by side, while in a vertical trellis the wires are run one above the other as in an ordinary fence. The posts for the trellis should be 7 feet 6 inches long, 7 inches wide, and about 4 inches thick. They should be set 18 inches in the ground, and 15 or 16 feet apart, dependent on the distance apart it has been decided to plant the vines.

The strainer posts should be of much heavier timber, and may be either round or split. They should be set 2 feet 6 inches in the ground, and must be well strutted or stayed, so as to take the strain of the wires, the portion in the ground to be free of sapwood. One strainer to every 80 yards of trellis will prove sufficient in most locations. The posts should be erected with their width across the row.

For a vertical trellis (Plate 14) holes are bored in the posts through which the wire is run. One wire is run as close to the top of the post as practicable, and a second, and sometimes a third wire, is run usually at 12 and 18 inch spacings below, 15 inches being the average spacing between these wires.

As stated previously, the horizontal type of trellis is considered most suitable. The distance between the two wires may be anything from 9 to 24 inches, but wide spacing has the advantage over the closer method in that it permits the entry of sunlight and air between the two sets of laterals, thus promoting the flowering and setting of fruit on the inner

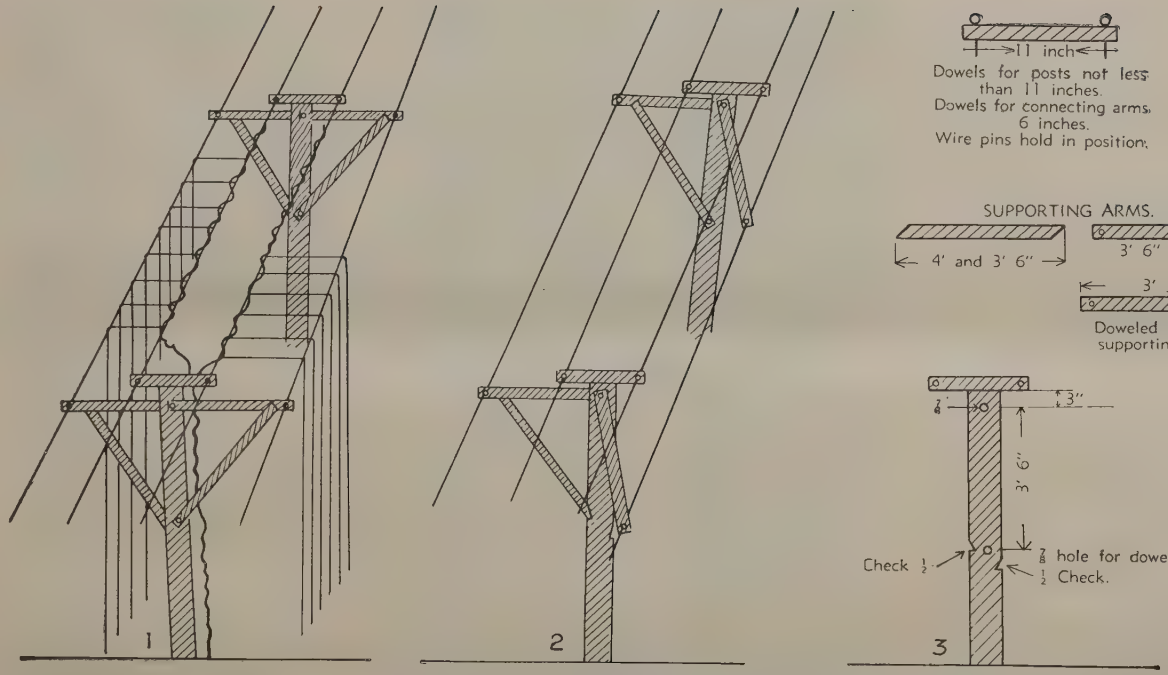


Plate 15.

DIAGRAM SHOWING HOW THE EXTENSION TRELLIS IS ATTACHED TO THE MAIN TRELLIS.

growth of the vine. At the same time this practice assists materially in maintaining a more open growth, allowing dead and diseased leaves to fall clear to the ground, carrying with them any fungus spores adhering to their surfaces.

In order to keep the wires apart in a horizontal trellis, a T-piece not less than 2 inches by 2 inches, cut to the length desired, is fastened to the top of the post and the wires run through holes bored in the ends of the T-pieces and strained on the strainer posts.

It is an advantage to make some provision whereby the wires can be kept strained, and so prevent heavily-laden laterals from sagging to the ground. Small cast-iron rollers may be procured cheaply and are excellent for this purpose, being easily operated and always in position.

Various gauges of wire are used. Some growers prefer No. 8 galvanised iron wire, while on some of the more recently erected trellises 10 by 12 gauge high tension steel wire has been used. This wire, although rather thin, is very strong and carries the weight satisfactorily; also, there is less stretching and sagging between the posts than is the case with iron wire. Black iron wire, although cheaper to buy, is not so suitable, as it soon rusts, stretches, and sags, necessitating propping up between the posts in order to keep the laterals and fruit clear of the ground.

Should the wires sag between the posts, stakes may be placed temporarily in position to support the wire until the crop has been harvested; then, after pruning, when the weight on the trellis has been reduced, the wires may be restrained with little possibility of the wire snapping.

An Extension Trellis.

The recommended practice is to keep lateral growth of the vines off the ground, and growers are advised to cut back vigorous growths to within 6 inches of the soil surface. When vines lie on the ground the fruit becomes badly scarred and of little value, except as low-grade or factory fruit. Shortening of laterals undoubtedly removes a considerable amount of growth capable of carrying fruit, and the following description of a temporary extension trellis shows how it is possible to increase the length of laterals without hampering cultural, spraying, or harvesting work, and enables a grower to get a higher yield of high-grade fruit from his vines.

Plate 15 illustrates a simple way of attaching an extension set of wires to existing trellises. This extension system makes possible increased lateral growth for an extra 2 feet on each side of the vine, or giving a net gain of 4 feet over the whole lateral growth of the vine. In addition, the extra shade provided by the extension gives greater protection from the direct rays of the sun for the main stem of the vine; this is very noticeable where trellises are 6 feet or more above the ground. Moreover, a greater area of ground is shaded during hot weather, and this helps to keep the surface soil at a moderate temperature, reduces the loss of moisture through evaporation, and makes weed control easier, thus reducing chipping costs and allowing more time for spraying and other jobs. After the fruit has been picked, and, if seasonal conditions are suitable, the bearing laterals should be pruned right back. The extension trellis can then be lowered out of the way beside the trellis posts, thus

allowing full use of the space between the rows of vines for the planting of green cover crops. When the new laterals have grown sufficiently to warrant its re-erection, the extension trellis can be raised into position again, the wire automatically picking up the lateral growth as it is strained to the proper tension.

The measurements given in the diagram are suitable for trellises where the rows are planted 8 feet apart. Where the planting distance is wider, the length of components may be increased. The system can be installed on either horizontal twin-wire trellises or on the vertical fence type; in the latter type, however, only the laterals from the leaders on the top wire should be trained over the extension. If sawn timber is used, approximately 15 feet of 2-inch by 1-inch hardwood battening is needed for an extension at each supporting post in the trellis, viz.:—

2 horizontal arms to support wire, each 3 feet 3 inches;

2 supporting members, each 3 feet 6 inches to 4 feet.

The few inches left over will provide sufficient material to make the dowels, which are cheaper than bolts and nuts. A ⅜-inch hole should be bored about 3 inches below the top of the post to allow for the wooden dowel on which the extension arms hinge. Of course, holes of similar size are bored in one end of each extension arm, a smaller hole for the wire to pass through being bored at the other end. The arms are set on opposite sides of the post as illustrated. Dowelling is strongly recommended, because the supports are not likely to be knocked out of the check notches during rough weather or when working among the vines.

The extension arms should be at least 3 feet 3 inches, or up to 3 feet 6 inches if desired, and this should allow sufficient room for the grower to reach the centre of the trellis from either side of the vine, in order to prevent the vine growth from matting and harbouring disease-infected leaves; at the same time, sufficient space is left to pass up and down the rows between the sets of trellis.

The supporting arms should be set at such an angle as to ensure the maximum support. Wooden dowels on which the arms are hinged should be sufficiently long to allow a small hole being bored at each end. Through these a nail or wire pin can be pushed, thus holding the arms in position. The same applies to the dowel holding the arms together near the end through which the wire runs.

No. 10 gauge galvanised wire is suitable for the extension. It should be strained when the arms have been dowelled in position, sufficient length being left at the strainer post so that it can be slackened off slightly when the extension is not in use. Small iron rollers suitable for straining the wire can be purchased cheaply. The wire for the extension is run through the straining post used for the main trellis. No extension arms should be attached to the strainer. The strain on the wire should be just sufficient to support the weight of laterals without sagging between posts. When the extension is not required it may be dropped to hang down alongside the post, the dowels holding the arms together near the wire being removed to facilitate this.

It is not necessary to completely dismantle the extension if the wood used is hardwood, but if softwood is used then it should be dismantled and stored until needed again. If the system is dismantled it will be necessary to mark or number each row and each section of

the extension; the posts also from which it is removed should have identification marks so that when required again each member can be re-erected in its original position.

Propagation.

Passion fruit plants may be propagated either from seed or cuttings, though the latter practice is rare. Growers are recommended to raise their own plants, and for this purpose only fully matured fruits selected from healthy vigorous vines should be used. Great care should be given to the selection of the fruits for seed purposes, as the passion vine is subject to several diseases and the possibility of transmitting these diseases by seed cannot be ignored. The seed may be allowed to remain in the fruit, which will naturally dry up, until it is required for planting. Another method is to remove the pulp, place it in a vessel of water for a few days until it ferments, when the seeds will easily separate from the fruit pulp. The seeds should then be washed in clean water and placed in the shade to dry.

Should early spring-ripened fruits be selected and the seeds planted immediately, seedlings will be ready to plant out in summer. A later sowing would provide seedlings suitable for autumn transplanting.

If spring planting is desired—this being the season most preferred —then seedlings should be raised from fruits maturing in the previous late summer. Such seedlings should be well grown before winter and be available when seasonal conditions are suitable for transplanting with every prospect of the young vines rapidly establishing themselves in their new situation. The site of the seed-bed should be very carefully selected. It should not be in close proximity to any other passion vines, either cultivated or otherwise, owing to the possibility of introducing woodiness or other diseases into the nursery. The soil should be friable and contain an abundance of plant food. After the soil has been well worked into a fine state of tilth, the seeds should be planted about half-an-inch deep in shallow drills made about 9 inches apart, the soil afterwards being firmly pressed and covered with half-an-inch of fine horse manure as a mulch. The seedlings should appear in from four to six weeks, and as they develop they may be thinned out to about 4 inches apart; those remaining will then develop into sturdy plants with good root development. Lanky, weak plants will result from any crowding in the seed-bed.

Some growers first erect the trellis and then plant several seeds at the required planting distance under the trellis, afterwards selecting the most vigorous of their young plants and removing the others. This practice is not recommended. Germination is often poor, the young plants are exposed to infection from any diseased vines which may be in the vineyard, and, generally, they require extra attention until they become well established.

Transplanting actually may be done at any time during the year, but from September to February is recommended, with a preference for the spring months. March to August planting is generally not advisable, except in very warm situations, as the plants often do not establish themselves satisfactorily and remain stunted.

When plants have reached a height of about 9 inches, they may be safely transplanted. If they have been allowed to grow much more than this, about a fortnight before transplanting the excessive top

growth should be cut back and the larger roots severed by pushing a spade down full depth between the rows.

Transplanting.

Dull, cool or moist weather is better for transplanting than hot, sunny or windy days. Under the latter conditions evaporation of moisture from the young plants is likely to be excessive. Except when the plants are set through paper mulch, it is advisable to dig large-sized holes for the reception of the plants. Approximately 12 inches in diameter and 12 inches deep is best. The position of each hole should be midway between the trellis posts. When planting, spread the roots evenly in a downward direction at about 45 degrees, and fill in fine top soil, which should then be well firmed. When the hole is completely filled with soil, the plants should be growing at approximately the same depth as they were in the nursery, but not deeper. If planted too deeply the crown of the plant is likely to be attacked by a fungus rot, which will destroy it.

Only as many plants as can be planted within an hour or two should be dug from the bed at one time, and after removal from the nursery they should be kept continually covered with a wet sack until planted. It is a good plan to give the bed a thorough soaking with water the day before digging the plants. The roots of the seedlings will leave the bed more easily, and will not be excessively damaged. They will also absorb moisture, which will assist them to recover from the shock of transplanting.

Training the Vine.

From the beginning the grower should have a definite system in mind, and train the vine systematically, so that a good solid framework is modelled on the trellis.

Within a few weeks after transplanting the young seedlings will have become established and vigorous growth will develop. Numerous shoots will appear from the crown of the plant and in most cases they rapidly overtake the original growth of the vine. When they have attained a growth of from 12 to 18 inches, one, two, or four (according to the grower's wishes) of the most vigorous growths should be selected to form the main stems of the vine. All other growth should then be carefully cut away. A light stake or pole should be driven into the ground alongside each seedling and fastened firmly at the top to the wires on the trellis. The stake acts as support for the vines until they have become firmly established on the wires. With the growth of the stems it is necessary to keep them tied at intervals of 9 to 12 inches to the stakes in order to prevent them from being broken or damaged through being blown about by wind.

The common practice with growers is to tie the vines after giving them a twist round the stakes. This is not the best method, because it necessitates at a later stage searching for the ties and removing them; if they are permitted to remain, they may cincture the vines as they grow. The best way is to tie a leaf stalk and tendril to the stakes, leaving the main stems clear of the ties. This is equally efficient as tying the stems, and avoids the necessity for later removal of the ties. Some extra time may be necessarily spent in the first place, but it will be more than made up later on.

Pieces of strong sacking cut into squares about 6 inches by 6 inches will unravel easily, and the strands make quite good ties.

All side branches arising from the stems between the ground and the wires should be carefully suppressed. Leaves only on the stems between the ground and the wires should be allowed to remain; these shade the stem and aid the development of the young plants.

Each grower must decide for himself whether he prefers one, two or four stems, but two stems are considered most satisfactory. The vines cover the trellis with comparative rapidity, and if planted in the spring produce a good crop in twelve to fifteen months. In addition, there is the advantage that, if one stem is damaged through any cause, the vine is not completely lost, the second stem remaining to carry on until a new stem or new leader is produced. It is important that the stems be as nearly as possible the same size, otherwise the more vigorous stem will rob the smaller and outgrow it. Vines trained on a single main stem take longer to establish a complete cover on the trellis, but during early life are much easier to keep in control, as the growth is not nearly so dense as that developed by the multiple stem system. On sloping land, where trellises may for some reason have been erected up and down the slope, two leaders are best, and as vines always grow more vigorously up hill than down, they should be trained on the wires to grow in the direction of the top of the plantation.

Training on the Vertical Trellis.

In the case of the vertical trellis, if only one stem is left it should be allowed to grow until it reaches the bottom wire, when the top inch or so should be pinched out. The stem will then throw out side branches near the top. Three, or perhaps four, of these should be selected, growing as near to one another as possible. Two should be trained in opposite directions along the bottom wire, and the other one or two carried on to the top wire where, if only one is carried on, the tip should be again pinched out and two wide branches allowed to grow for training in opposite directions along the top wire. If two branches are carried on from the bottom wire, they are merely trained in opposite directions along the top wire.

When two main stems are allowed to grow from the ground, the tip of one should be pinched out on reaching the bottom wire and two branches allowed to develop for training along the bottom wire, whilst the second stem is permitted to grow until it reaches the top wire where it is similarly treated.

In the case of four main stems, two are trained in opposite directions along each of the wires.

Training on the Horizontal Trellis.

With the horizontal trellis, if only one stem is left the tip should be pinched out when the wires are reached, and four branches growing as close together as possible should be allowed to develop for training in opposite directions along the two wires.

If two stems are left, the tips are pinched out and two branches allowed to grow from each, whilst with four stems they are merely trained in opposite directions along the wires as they reach them.

The sections of the vines which grow along the wires are termed "leaders." They should not be permitted to ramble along the wires at

Plate 16.
A HORIZONTAL TRELLIS WITH THREE WIRES.

Plate 17.
A HORIZONTAL TRELLIS WITH FOUR WIRES.

will supported only by the tendrils, but should be given long, gradual turns round the wires and loosely tied at intervals, care being taken to maintain the turning in the same direction to prevent sagging loops. Sharp turning round the wires should also be avoided, as this may tend to check the sap flow. As the leaders proceed along the wires lateral growth will develop, and this will be accelerated if leader terminals are nipped out on reaching the approaching growth of the neighbouring vine.

The laterals should be encouraged to grow straight down rather than be allowed to grow in any direction. By controlling the laterals in this way the vines are kept more open, and the work of spraying, harvesting and pruning is made very much easier.

Other Forms of Trellis.

Apart from the vertical and horizontal trellises described, there are a number of modifications which some growers adopt with varying results. In the main they are more expensive to erect, and it is doubtful whether recompense is obtained for the additional outlay.

Plate 16 illustrates a horizontal trellis with three wires. Two leaders are grown along the middle wire and the side laterals are trained over the outside wires.

Plate 17 shows another form of horizontal trellis with four wires in which four leaders are grown along the inside wires and the side laterals trained over those outside. This system permits of wider cross pieces being used on the trellises, but often results in a mat or shelf of vines on the top of the trellis, which holds dead and diseased leaves instead of permitting them to fall to the ground.

Plate 18 shows a six-wire vertical type of trellis on which twelve leaders are allowed to grow. The use of a trellis such as this results in the side laterals from the top leaders tending to exclude light and air, and consequently smothering those on the bottom wires.

Plate 19 illustrates a trellis made with welded sheep fencing. This type is used in Victoria, where the growth of vines is very slow in comparison with their vigorous development in Queensland. The stems or leaders are spread fanwise over the wires. Good crops are borne and the vines are well spread, but considerably more time is occupied with pruning than when the two-wire horizontal or vertical trellis is used.

Cultivation.

Caution is needed in regard to the use of cultivation implements, especially when the vines are in vigorous growth. Passion vines are comparatively shallow rooted, and not a few growers have suffered considerable loss when, with the best intentions in the world, they have ploughed or cultivated deeply at a time when a good crop was hanging, and afterwards found their fruit just withered and fell, and the vines assumed a sickly yellow appearance. Such a condition will follow the cutting and breaking of feeding roots at a time when the vines most need their support. Cultivation, then, during the main growing and fruiting periods should be shallow and confined merely to the control of weeds and the breaking-up of the top inch or so of surface soil to prevent caking.

Plate 18.
A SIX-WIRE VERTICAL TYPE TRELLIS.

Plate 19.
A TRELLIS MADE WITH WELDED SHEEP FENCING WIRE.—The leaders are spread fanwise.

It is more or less essential to break up the soil deeply once a year, and this is best done during the winter about July after the vines have been pruned. Where horse or tractor drawn implements are used, the land up to within 18 to 24 inches of the vines may be ploughed to a depth of about 6 inches, whilst on steep and rough locations, or where the land has not been stumped, cultivation as deeply as possible up to the same depth is best achieved by the use of mattocks or pronged hoes.

Care is also essential when attempting light cultivation or weed control around the immediate base of the vines in order to ensure that the crown and main roots are not injured by implements. Soil-frequenting fungal organisms often quickly enter at such points of injury and set up a condition known as base rot. It is preferable to hand pull all weeds in the vicinity of the stems. Furthermore, during cultivation the crown of the vines should not be covered with soil or with destroyed weed growth, but left exposed to the sun and air. Little trouble will then be encountered with base rot.

Vines should be kept well cultivated along the lines set out from the time they are planted. They will then develop rapidly and produce good crops. Vines insufficiently cared for when young lack vigour, and their development is retarded. Even if they do produce a large quantity of fruit, it is usually small and of poor quality. Older vines will also suffer during hot dry spells if cultivation is neglected, as the soil cannot hold sufficient moisture at such times to support both vines and weeds.

Plate 20.

Reconditioning Passion Vine Soils.—Green-manure crop of mustard ready for turning under.

Green Manuring.

The growing of green manure crops planted between the trellises towards the end of summer and prior to the wet season is a matter which should be given attention. Crops such as cowpea, Poona pea, tick beans, field peas, mustard, lupins, and others are suitable. If grown through

the wet season and into the winter, they will not seriously interfere with the growth of the vines, they will assist in controlling erosion, and when turned under will materially assist in improving the fertility of the soil. On soils of good to medium fertility a dressing of about 200 lb. of fertilizer containing nitrogen to the acre at the time of sowing the seed will be of considerable assistance in the production of a good cover.

On poorer soils or in vineyards which have been badly washed, or where hot fires have occurred, the condition of the soil can be improved by turning under green cover crops. On badly washed areas where difficulty may be experienced in getting legumes, such as cowpeas and Poona peas to grow, mustard will generally provide a good first crop, subsequently peas may be planted successfully. Cover crops on poor soils will be materially assisted with a preliminary dressing of 200 lb. each of sulphate of ammonia and superphosphate.

It has been observed that a crop of skinless barley planted between rows of young vines and ploughed under in February has proved beneficial. It should be noted, however, that after the vines have covered the trellises, ploughing in February should be limited to the middle of the rows, as the root system of the vines will have extended well out by that time. Green crops, planted subsequent to the first year's growth of the vines, should be confined to a narrow strip along the middle of the rows.

Irrigation.

Earlier it was mentioned that, if a dry spring extends into a hot, dry summer, some defoliation and loss of fruit must result. The provision of irrigation water where available will prove an entire guard against such a setback, and will prove profitable in other ways in so far that the vines can be kept growing and blossoming practically throughout the year. It will be noted under the heading of pruning that the time for doing this work is governed to some extent by prevailing weather conditions. Aided by irrigation, this handicap disappears. The vines can be well watered prior to pruning, and again after the operation without danger of suffering any check, and furthermore, can be forced into growth at once for the production of an early crop. Furrow irrigation is to be preferred where the land is nearly level, but on sloping land overhead spraying is quite successful.

During very dry periods, the owners of some plantations resort to hand watering where irrigation is not possible, and it is remarkable how even a small quantity of water poured round the stem of each vine every second day will enable the plants to retain not only foliage, but fruit. The watering is best done late in the afternoon to avoid loss by evaporation.

Fertilizing.

The passion vine, being a vigorous grower, demands a plentiful supply of available plant food. The soil, therefore, should be at least reasonably fertile. Where planted on good virgin land there should be ample nutritive elements available for the first year or two. Subsequently, and also from the outset on poorer areas, artificial fertilizers will prove of considerable benefit.

A recommendation as to the best formula to use for all plantations cannot be made dogmatically, for better results have been obtained by

the application of certain mixtures on some areas, whereas other mixtures have been equally successful in other plantations. Each grower, whilst applying a general mixture to his vines, should carry on small scale experiments with others and note any difference. The amount of fertilizer required will depend to some extent on the fertility of the land, poorer areas requiring more than those of better quality, but from 4 cwt. to 8 cwt. per acre will prove a reasonable application.

The various fertilizer dealers stock general orchard mixtures which have given good results in many instances, whilst other growers experimenting with a special 10-6-10 mixture of sulphate of ammonia, superphosphate and sulphate of potash have produced excellent crops. Whatever fertilizers are applied are best divided into two dressings, one during the winter cultivation about July, and a second about January, in order to be in time for the autumn flowering for the winter crop.

Pruning.

Some growers claim that pruning definitely gives them bigger and better crops, others say they get just as big crops from unpruned vines, but admit that the size of the fruit and its quality is not as good as that from pruned vines. In any case, whatever influence pruning has on the size of crops, the wise grower will prune for the following reasons:—

To keep the vine in good health;

To remove diseased, dead, and unprofitable growth;

To keep the growth in check on the wires in order to admit light and air and prevent congestion;

To induce the production of healthy, vigorous wood on which high-grade fruit is set;

To replace spent, bare leaders by the development of new ones;

To keep the lateral growth clear of the ground and properly spaced;

To regulate the time of bearing so that the highest market prices are obtained for the fruit;

To assist disease control and increase the life of the vine;

To cheapen the cost of spraying.

When left unpruned, vines soon become a tangled mass of wood and foliage in which fungus diseases may develop and rapidly shorten the life of the vine. It is essential, therefore, to maintain an open habit of growth in order to admit plenty of light and air to all parts. All dead and diseased wood should be cut away and burnt in order to reduce the risk of infection. The best fruit is produced on healthy vigorous laterals, and the object naturally is to produce the greatest amount of such growth possible. It will be found that, by checking the growth of laterals when they are about 6 inches from the ground, strong secondary laterals on which fruit will be borne will be produced all along the sides of the laterals, and the bearing area of the vine will be thus increased considerably. In addition, the vine will be kept free of the blemished fruit which would be produced if the laterals were permitted to grow on the ground. The shortening of laterals to keep them clear of the ground may be done at any time without harming the vine.

Passion vines should be given a heavy pruning once each year. There are modifications in some instances which are discussed later on. Usually, July or August is the best time, when most of the winter crop has been harvested, and before spring growth commences. The most suitable time for commencement of pruning will vary in different districts, and possibly even in different parts of the same district, due to environmental factors bearing on growth and crops, as described earlier. A most important feature also to be borne in mind is that *vines should not be severely pruned during a very dry spell.* The soil should be in good condition so far as moisture is concerned. Severe pruning when the ground is dry has caused the death of many vines. Pruning at about the time mentioned is preferable from the aspect of control of a serious fungus disease known as Brown Spot, information concerning which is obtainable upon application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

There are no hard and fast rules for pruning. Each vine may present a different problem, and consequently only general recommendations as to the procedure will be discussed. It should perhaps be mentioned that pruning is apt to prove a slow and tedious job, and much patience is required to do the work properly. However, the grower will be well repaid for the time and care expended. Firstly, with the aid of a reaping hook, all laterals should be severed at about 12 inches below the trellis wires. When this has been done, the great bulk of the vine has been removed, and it is possible to obtain a much clearer view of the more intimate pruning required. From the leaders on the wires all dead, diseased, and spindly wood should now be cut away, using a pair of secateurs, and the stumps of the stronger laterals which

Plate 21.

VINE AFTER PRUNING.—The laterals are cut back to 9 to 12 inches from the leaders on the wires. It is at this stage that deep cultivation is best practised.

it is intended to leave should be allowed to remain about 9 to 12 inches long. Each shortened lateral will then have two or three buds from which the new growth will start for the next crop. It is not advisable to cut back more severely than this, as the bearing capacity of the vine may be affected.

Some growers prefer to give two light prunings each year—one during the winter, and a second about January-February after the main summer crop has been harvested and before flowering for the winter crop commences. Others, in addition to heavy winter pruning, like to give a light pruning following the summer crop. Both modifications give good results, the latter in particular. When conditions are too dry for severe pruning during the winter, the system of two light prunings can be safely adopted.

Light pruning (by which is meant in general the cutting away of up to half the length of the laterals) at any time of the year, provided there is sufficient soil moisture, will cause the vine to put forth new growth and blossom, the development of which regulates the period of production of a crop.

Under ordinary circumstances heavy pruning in the winter will produce a big summer crop and a somewhat smaller winter crop. By shortening back the flowering laterals about October and sacrificing portion of the summer crop, a bigger intermediate crop will be secured, provided, of course, that the weather is not dry. Similarly, by pruning back the flowering laterals for the ordinary winter crop about February, a late winter crop can be secured.

In warm localities the vine puts out vigorous growth much earlier than in exposed and colder areas. The grower is advised to carefully note his own local conditions and prune to suit that particular location.

Replanting.

As the commercially useful life of a passion vine is generally about four years, some provision should be made for continuity of production. This may be done by rotation and by replanting.

Under normal vineyard conditions the heaviest crops will be produced when the vines are from two to two and a-half years old, after which they gradually decline in production and quality of the fruit. In order, therefore, to keep up a supply of good quality fruit, new vines should be coming into bearing every two years.

Young seedlings may be planted midway between the older vines, and after the summer crop has been harvested every second one of the older vines may be cut out and the new vines trained on the trellis in the vacant spaces. As they come into bearing the remaining older vines should then be replaced in turn by fresh seedlings.

Although this method gives a replanting every two years, and a fairly high grade of fruit is produced, it has the disadvantage of necessitating an increased amount of pruning and spraying, as the young vines become infected with brown spot and woodiness to a much greater degree than if planted out in a fresh area.

By rotation areas can be kept isolated from each other either by distance or natural vegetation. Young seedlings planted out do much better under this system. They are not so much exposed to infection

from diseased neighbouring plants, are more vigorous in growth, and produce earlier and heavier yields.

Under rotation extra trellises and more extensive cultivation are necessary. This additional expense is offset, however, by the advantages already mentioned. Under this system, too, the land can be periodically spelled from passion vine growing, and the trellises more easily repaired or replaced as required.

Whatever method is decided on, it must be borne in mind that to obtain the maximum profits from passion fruit growing provision must be made for the setting out of new vines at regular periods to replace the older ones as their production falls in quality and quantity. Experience suggests that a two-year system of replanting or rotation is the most satisfactory. This necessitates the planting out of young vines during the spring of every second year.

A three-year rotation or replanting could be adopted, provided the vines remain healthy, vigorous, and productive. Either rotation or replanting must, however, be done at a shorter period than every four years if quality and quantity production of fruit is to be maintained.

Harvesting and Packing.

Harvesting, packing, and marketing is quite as important as production, and every grower should aim at presenting to buyers well-matured, properly graded, attractively packed fruit. Enhanced prices received for well got-up fruit will justify the time and labour expended on its preparation for market.

Fruit should be gathered daily, preferably in the early morning or late evening, when the fruit is cool; it is then not so likely to arrive on the market in a wrinkled or shrivelled condition. All dropped fruit should be picked up first, as a couple of hours in the hot sun is sufficient to cause severe scalding and possibly render the fruit unsuitable for packing.

The degree of maturity at which the fruit is picked from the vine is of vital importance, and judgment is required in order to obtain the right colour without the fruit being so far forward that it is likely to wrinkle. Good colour is very desirable, and during the cooler weather the fruit should be picked when it has assumed a deep purple. However, during hot weather fruit should be gathered when just a light purple shade has extended over half to three-quarters of the surface of the fruit.

When harvesting during wet weather allow the fruit to dry off thoroughly before being packed. All fruit should be carefully picked to prevent the skin being damaged. This is best achieved by grasping the fruit in the hand with the thumb and forefinger on the fruit stalk, then with a forward pressure of the thumb and a backward pressure of the forefinger, the fruit will be easily detached at a point where the fruit stalk joins the tendril just above the dead flower.

The picked fruit should be placed—not dropped—into the picking boxes or tins, which should be placed on the ground or slung on the body. These, when filled and until despatched, should be kept as cool as possible and sheltered from strong winds.

Bordeaux spray can be removed by immersing the fruit in a weak solution of hydrochloric acid for one and a-half to two minutes, afterwards washing off with fresh water and being allowed to drain before packing.

Passion fruit forwarded to the fresh fruit market should be packed in half-bushel dump cases, and full instructions for packing the different grades are contained in an illustrated booklet which may be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Fruit intended for factory use need not be packed in cases, but may be forwarded to the canneries in sugar bags or similar containers.

Diseases and Pests.

The passion vine does not usually suffer from any serious attack by insect pests. Spotting of the fruit results from the feeding activities of some minor sucking insects, but little damage is done beyond a slight blemish of the outer skin. As the pulp is not affected, the fruit is not harmed. Fruit flies have been known to attack the fruit in its green stage. The eggs, however, do not mature, but the skin surrounding the puncture becomes hard and detracts somewhat from the appearance of the matured fruit.

Fungus disease such as brown spot and a virus disease known as woodiness or bullet, to which the passion vine is very susceptible, are the main causes for the premature failure in many vineyards. Powdery spot is a minor fungus disease which attacks the terminal growths and fruit during the cooler months of the year. Its attack is more serious on vines up to eighteen months old, since the proportion of the plant affected is then relatively greater.

Brown spot is the most troublesome disease affecting the vine. It attacks leaves, stem, runners, and fruit, causing considerable damage, and if neglected will result in the death of the vine within two years. Young vines are not so seriously attacked as older ones, as the more open growth admits light and air, and permits most of the affected leaves to fall to the ground, carrying the fungal spores with them.

Woodiness is a serious virus disease, and growers are advised to exercise every care in an effort to prevent its spread.

A pamphlet dealing with the control of passion vine diseases may be obtained on application to the Department of Agriculture and Stock, Brisbane, B. 7.

CHANGE OF ADDRESS.

Changes of address should be notified at least fourteen days before the date of issue with which the change is to take effect. The former address should be given as well as the full Christian names and surname of the subscriber.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

PLANT PROTECTION

Soft Rot (Water Blister) Disease of Pineapples.

H. K. LEWCOCK, Senior Research Officer.

AT one time or another, soft rot of pineapples has been reported from most countries which produce this crop commercially, but it is only where the fruit has to be transported over long distances before being marketed that it has come to be regarded as a serious disease. Every summer, soft rot is responsible for heavy losses in Queensland-grown pineapples consigned to the Sydney and Melbourne markets where the disease is known to the trade as "water blister," while it is said to cause wastage of from 3-5 per cent. in all pineapples shipped from Cuba and Puerto Rico to New York. In this latter market, as well as in Hawaii, the disease is known as "black rot." Wastage from the disease in Hawaii is very small, probably because the bulk of the fruit grown there is processed at the canneries within a few hours of its removal from the plants.

Symptoms.

Soft rot rarely attracts attention before the disease is well advanced. In the early stages there is little external indication of damage, though the skin overlying affected portions of a fruit usually appears water-soaked—hence the term "water blister." Underneath these areas, however, the flesh is very soft and watery as well as somewhat deeper in colour than the surrounding healthy tissue. A characteristic of soft rot, which serves to distinguish it from other pineapple fruit rots, is that the skin above affected tissue is thin and brittle and breaks readily under slight pressure. In the final stages of the disease the core disintegrates as well as the flesh and the fruit collapses at touch. If the rot starts at the stem end of the fruit (Plate 22) it may advance throughout the whole of the flesh before there is any external evidence of decay except for a slight softening at the base. Accompanying the decay is a sweetish odour, quite distinct from the sour fermentation smell given off by yeasty rot.

Causal Agent.

Soft rot is caused by a fungus* which is also the causal agent of the disease of young pineapple plants known as "base rot." Infection develops from dark-coloured spores which the fungus produces in great numbers on broken or otherwise exposed surfaces of decaying fruits, as well as on diseased vegetative organs such as tops. In the later stages of the disease, spores also form along the core of an affected fruit, turning it black. In the great numbers in which they are produced the spores appear as a soot-like crust though, individually, they are too small to be seen by the naked eye. Like seeds of the higher plants, the spores of the soft rot fungus are resistant to drying and they may

* *Ceratostomella paradoxa* (De Seyn) Dade.

remain dormant for many months awaiting moisture and temperature conditions favourable for germination. Because of their minute size, only the slightest air movement is required to disperse them.

Mode of Infection.

Infection occurs mainly during picking or packing operations from spores, which have been blown on to the fruit from nearby infective material or from the floor of the packing shed. As the fungus is unable to penetrate the unbroken skin of the fruit, however, spores must lodge on freshly cut surfaces or in recent scratches or growth-cracks before they can germinate and bring about infection. Once the fungus has entered the fruit, nothing can arrest the development of the disease except a sudden lowering of temperature. Growth of the fungus is most active at temperatures between 70 and 90 deg. Fahr., while it is almost completely arrested below 50 deg.

Plate 22.
Soft Rot.—Early stages of the disease following stem-end infection.

The majority of infections take place through abrasions, bruises, and cracks on the sides and shoulders of the fruit or through the broken or cut stem at its base, but they may also occur through the top. Under comparable conditions as regards handling the fruit, side infections tend to preponderate over stem-end infections following a rainy period when growth cracks on the sides of the fruit often become prevalent, while infections through the top end may reach appreciable proportions in the case of multiple-topped fruit which require trimming prior to packing.

Conditions Favouring Development of the Disease.

As relatively high temperatures are necessary for the development of soft rot, it is of importance in Queensland only in the summer, chiefly during the months of February, March, and April, when the crop harvest is at its peak. Infection rarely takes place until after the fruit is picked, and even under favourable conditions there is an interval of about two days between the time of infection and the appearance of recognizable symptoms of the disease. For this reason, soft rot is seldom seen on the plantation or in the packing shed, and losses from it are largely confined to fruit marketed in the Southern States. In hot weather, the disease can develop fully during the time that fruit is in transit to these markets, and the collapse of one or two affected fruit in a case may cause it to be dripping wet by the time it reaches its destination. For this reason, the wastage attributed to soft rot in the Southern markets is often out of all proportion to the percentage of fruit actually affected by it since, in the summer months, the trade always associates wet packing or cases with the presence of this disease. In fact, it is usual for the whole of a consignment to depreciate

in value as soon as a fruit affected with soft rot is found in it, as an agent is always anxious to clear suspected fruit off his floor with the least possible delay in order to avoid complete loss.

Control Measures.

Provided fruit receives careful handling during picking and packing, it is only necessary to see that no infective material is left lying in or around the packing shed to ensure that wastage from soft rot is reduced to insignificant proportions, if not entirely eliminated. Care in handling implies that the fruit is picked into baskets, not into bags, in order to avoid abrasions which would serve as possible infection centres, and that all cracked, sun-burned, "weeping" or "knobby" fruit is sent to the canneries or to other nearby markets where it would pass into consumption before the disease had time to develop. Infective material includes discarded fruits, as well as tops, knobs, and other trimmings in which the fungus causing soft rot could develop and produce spores. Recurring losses from the disease are almost always traceable to neglect or slovenliness in the disposal of refuse of this kind.

Proper grading of the fruit so that it may be tightly and firmly packed without squeezing or forcing the fruit into the cases is a safeguard against wastage from soft rot, because bruises inflicted during packing are all possible centres of infection (Plate 23). Similarly, skin abrasions occurring during transit as a result of slack packing also provide points of entry for the fungus, should spores be present on the skins of the fruits.

Packing sheds which have become contaminated with the causal fungus of the disease should be disinfected by spraying them with a 5 per cent. solution of formalin. In this connection it should be noted that sheds with dirt floors are much more difficult and costly to sterilize than those with wooden or concrete floors, as it is necessary to soak them with formalin solution to secure effective destruction of fungus spores contained in the loose, dry surface. As an additional precaution, it is always advisable to sprinkle a dirt floor with water prior to packing fruit for interstate markets. But since it is always a difficult matter to keep dirt floors free of infective material, such as knobs and top trimmings, it will generally be found that the reduction in wastage from soft rot which follows the laying down of a wooden or concrete floor in a packing shed soon pays for the cost of installing it.

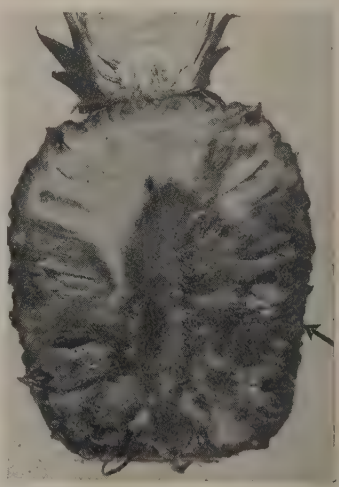


Plate 23.

SOFT ROT.—Late stage of the disease following side infection through bruise.

Ordinarily, care in handling the fruit and cleanliness in and around the packing shed are all that is required to insure against loss from soft rot. Following reports of the occurrence of the disease in fruit consigned to the Southern States, however—indicating infective conditions in the packing shed—the dusting of the stem ends of the fruit with a mixture of benzoic acid and kaolin is often helpful in reducing further wastage until the shed can be thoroughly disinfected. Suitable proportions of benzoic acid and kaolin are: one part of the former to four parts of the latter, intimately mixed. Alternatively, the stem ends may be painted or sprayed with a 2½ per cent. to 5 per cent. solution of benzoic acid in methylated spirits. In either form, the benzoic acid should be applied to the stem ends not later than two hours after picking the fruit and, in the case of the powder, care should be exercised to see that it does not get on to the skins of the fruit and so detract from their appearance. In any case, too much reliance should not be placed on the benzoic-acid treatment since it is supplementary to, and not a substitute for, cleanliness, and careful handling.

As growth of the causal fungus is almost entirely arrested at temperatures below 50 deg. Fahr., rapid cooling of the fruit soon after picking should prove effective in reducing wastage from soft rot. At present, however, facilities for cooling fruit prior to shipment are not available in pineapple-growing areas in Queensland.

ANSWERS.

(*Selections from the outward mail of the Government Botanist.*)

Slender Thistle. Poison Peach.

J.A.K. (Kingaroy)—

1. *Carduus pycnocephalus*, the Slender Thistle. This thistle is moderately common in Queensland but is not as aggressive as some of the other thistles that are common farm and pasture weeds. Its eradication, however, is recommended. It is not known to possess any poisonous or harmful properties at any stage of its growth.
2. The Peach-leaf Poison Bush or Poison Peach (*Trema aspera*) a native shrub widely spread through coastal and near coastal Queensland. It is generally regarded as a bad poisonous plant to stock, although at times stock eat it for long periods without any ill effects following. Experimental feeding, however, shows that it is capable of causing death. The poisonous principle so far has not been ascertained. It was at one time thought to be a prussic acid yielding glucoside, but this is only very infrequently present and apparently developed in such minute quantities as not to make it dangerous.

Broncho Grass. Mouse Barley.

W.M.G. (Dalby)—

1. *Bromus rigidus*, the Great Brome Grass or Broncho Grass; a weedy annual grass; a native of Southern Europe, widely naturalised in Australia. In Queensland it occurs mostly as a weed of cultivation during late winter and spring. It belongs to a group of annual Brome grasses with large seed heads and little foliage. They may provide a bite for stock during the very early stages of their growth, but soon become dry and unpalatable.
2. *Hordeum leporinum*, the Mouse Barley. A native of Europe now widely spread in most temperate countries. In Queensland, it is most frequent as a weed of cultivation during winter and spring. It may give a certain amount of feed in its younger stages, but under Queensland conditions soon goes to seed and becomes harsh and unpalatable. A serious characteristic of the grass is that the seeds may cause irritation and bad sores in the nostrils, mouth, and eyes of animals. In the Southern States it is frequently called barley grass, and is referred to as such in most accounts of the species. In Queensland, however, this local name is given to various other grasses.

The Cleaning of Dairy Utensils.

E. B. RICE.

INVESTIGATIONS pursued by field and laboratory officers of the Dairy Branch in recent years have confirmed observations recorded in many other countries that the chief single factor in hastening the deterioration of milk and cream is contamination picked up from improperly cleansed utensils and equipment—such as buckets, cans, separator, milking machine, and cooler.

The cleansing of any dairy utensil involves two stages:—

(1) Washing to provide a physically clean surface.

(2) Sterilization to ensure virtual freedom from bacteria.

Each stage is complementary to the other, and efficient cleansing is possible only if there be a clear recognition of this by the dairy farmer. This point is deserving of special emphasis. Numerous examples could be cited of the failure to raise quality because of lack of a proper appreciation of these fundamental factors.

The procedure to be followed in the care of dairy utensils, together with the underlying principles, are discussed hereunder in their proper sequence.

Rinsing.

Rinsing with cold or lukewarm water immediately after use.—This preliminary rinsing to remove milk residues is essential. Milk contains a substance known as albumin, which is an excellent medium for the growth of certain undesirable bacteria capable of causing "off" flavours. The albumin, which forms a thin film over the surface of the utensil, is soluble in cold or lukewarm water, but insoluble in hot water. The preliminary rinse is therefore intended to dissolve and remove the albumin which would coagulate and be difficult to remove if hot water were used for the first step in washing up. By the constant use of hot water without the prior cold rinse, the albumin and other constituents gradually build up the thickness of the deposit until there is formed on the surface of the utensils what is known as a milkstone deposit, which supports the growth of certain bacterial species capable of resisting high temperatures and not destroyed even after milk or cream is subjected to pasteurisation in the factory.

Dairy utensils should be cleansed immediately after milking, but if for any reason washing up must be delayed, it is most important for the utensils to be at least rinsed with cold water in order to prevent the milk residue from sticking to the surface and subsequently becoming difficult to remove.

Scrubbing and Washing.

Using a scrubbing-brush, wash thoroughly (both inside and outside where necessary) with warm water in which washing soda or other cleanser is dissolved.—The warm water used in the second procedure in washing up should be just warm enough for the comfort of the person responsible for dairy cleansing (approximately 120 deg. F). This water must contain a fat-emulsifying compound, as pure water itself would leave the utensils greasy and thus not in the state of physical cleanliness so essential prior to sterilisation. Soap should never be used in this water as it is not a fat "solvent." Washing soda is readily available at all country stores, cheap, and for dairy farm purposes, an efficient fat emulsifier. A good brush, *not* cloths, should also be used. Three tablespoonfuls (one handful) dissolved in 4 gallons of water gives a solution of the requisite strength. For cleaning milking machines, a weak caustic-soda solution (one tablespoon to 4 gallons of water) possesses certain advantages, but washing soda also is quite effective.

Near-Sterilization.

Near-sterilize by immersion in boiling water or by steam. "Scalding" which is the usual final procedure on most farms, is only efficient if plenty of boiling water is used.—Efficient sterilization of dairy utensils is dependent on (*a*) thorough prior washing, (*b*) adequate exposure to the sterilizing medium, (*c*) drying, (*d*) after-care to avoid re-contamination by dust or other means. For near-sterilizing, as applied in dairying, there are three recognised methods:—

(1) Steam.

(2) Boiling water.

(3) Chemical (usually chlorine compounds).

It is not proposed to insist on any particular method as most suitable and applicable under the diversified dairying conditions in Queensland. Each method may be commended for certain purposes. Moreover, the degree of skill and carefulness of the individual, rather than the method, often determines the efficiency of the work done. For the production of the highest grades of milk for human consumption, on farms equipped with milking machines, and on hand-milking farms producing large quantities of milk—in fact, in any circumstances in which much equipment and large numbers of cans have to be used—steam sterilisation is undoubtedly the most efficient method. Any farmer contemplating the outlay on a milking machine should be prepared and able to incur the extra expense of installing a steam sterilizer. This is, in fact, now a compulsory requirement in this State.

Boiling Water Essential.

It is recognised, of course, that some dairy farmers may not be able to afford a steam sterilizer. A satisfactory degree of sterilization may be attained with boiling water on small farms. A bricked-in domestic copper, or other boiler, of 12 gallons capacity—as prescribed in the Regulations—may be regarded as providing the minimum

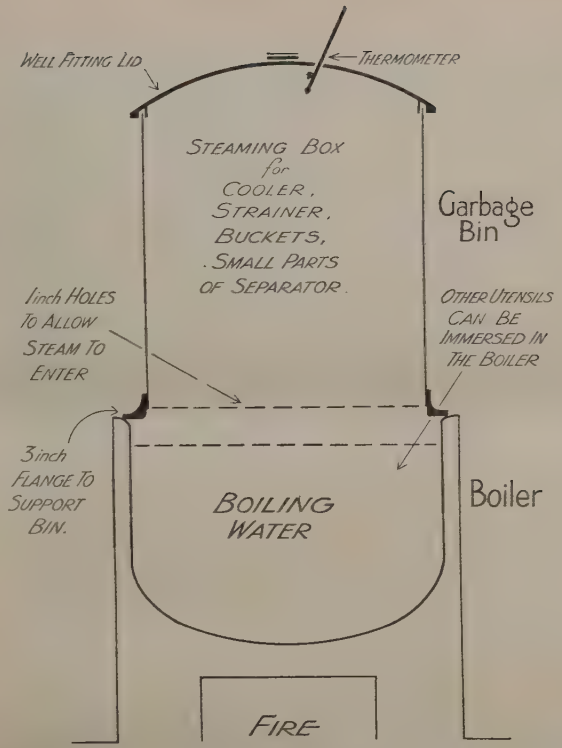

WELL FITTING LID
THERMOMETER
STEAMING BOX for COOLER, STRAINER, BUCKETS, SMALL PARTS OF SEPARATOR.
Garbage Bin
1inch HOLES TO ALLOW STEAM TO ENTER
OTHER UTENSILS CAN BE IMMERSED IN THE BOILER
3inch FLANGE TO SUPPORT BIN.
BOILING WATER
Boiler
FIRE

Fig. 1.

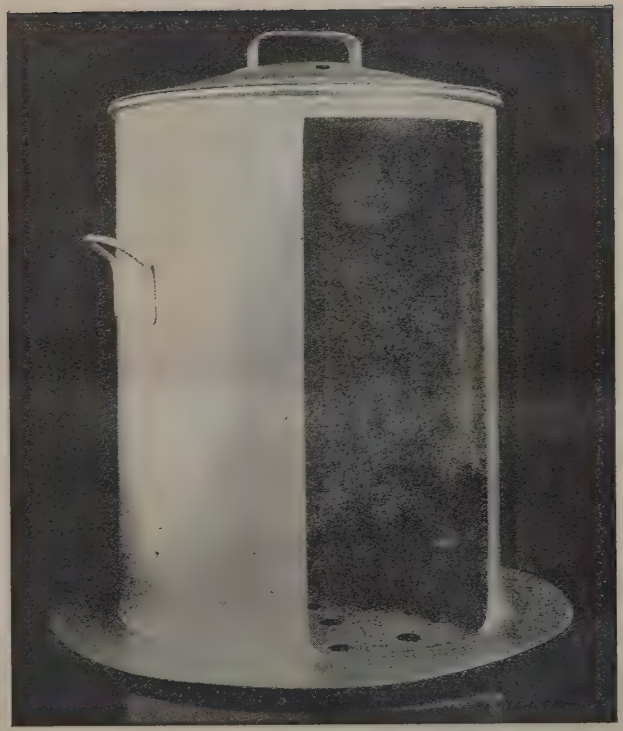


Fig. 2.

Plate 24.

PHOTOGRAPH AND DIAGRAM SHOWING CONSTRUCTION OF A CHEAP AND EFFECTIVE STEAM STERILISER.

quantity of hot water essential for dairy cleansing operations. Boiling water achieves near-sterility only if the utensils are completely immersed in it. The usual "scalding" by pouring a quantity of boiling water into one can, transferring the hot water to another can, and continuing to use the same lot of water for a number of cans, must be condemned. By this means, the first couple of cans may be reasonably near-sterilized, but by then the temperature of the water shall have dropped below the thermal deathpoint of most bacteria and the remaining cans therefore cannot be properly treated. Much better results would be achieved by separately placing a smaller volume of boiling water straight from the copper into each vessel. Small pieces of equipment, after washing, should be put into the copper for a few minutes. Most of the bacteria which thrive in milk are destroyed instantaneously on exposure to boiling water, but will survive for thirty minutes at a temperature of 145 deg. F., and for up to five minutes at 160 deg. F.

Plate 24 illustrates a method whereby an ordinary copper may be converted to steam sterilization. Steam is conveyed from the copper to the sterilizing compartment, which is fixed over the copper, by means of a short length of piping. This method gives satisfactory results on small dairy farms.

Plate 25.

A type of water boiler which suppliers to the Yargullen Cheese Factory have installed at a cost of approximately £3 is shown in Plate 25. It consists of a bricked-in semi-cylindrical trough of fire steel 30 inches by 18 inches by 12 inches. It is superior to an ordinary copper as the trough is large enough for cans and other equipment to be immersed in the boiling water.

Chemical sterilization alone is not recommended for farm purposes, although it is admirable for certain factory operations in which there are practical limitations to the use of steam. However, used in combination with other methods by persons understanding it, chemical sterilization has, for certain farm uses, proved beneficial. For example, milking machines may be flushed through with a dilute chlorine solution (100 parts per million) preparatory to milking, the residual

solution being then used to rinse out cans, cooler, and other utensils. The objective is to destroy bacteria which multiply in the utensils in the intervening period between milkings.

Draining.

Allow utensils to drain and dry in an inverted position on a metal draining rack situated in a dust-free atmosphere; if desired, the rack may be in a sunny position. Do not use a cloth to dry dairy utensils.— Any bacteria which may survive the washing and near-sterilization will be inert types and the drying of the utensils will prevent their growth. Bacteria are unable to multiply in dry utensils, while even the minutest quantity of moisture remaining in a utensil is capable of sustaining the growth of millions of bacteria which would "seed" any milk or cream subsequently added. The use of cloths should be strictly avoided for the final drying, as they reintroduce bacteria. If steam or really hot water is used for final sterilization the residual heat will cause the utensils to dry rapidly. Thus as all food for bacteria was removed by careful washing, all bacteria were destroyed by the boiling water or steam, and all moisture was drained off or evaporated by the residual heat of the utensil, any few bacteria which may re-enter from the air of a hygienic dairy, will not cause undesirable changes in milk or cream subsequently placed in the utensils.

Summary.

Recommended summarized procedures are as follows:—

(*a*) Immediately after use, rinse with cold or lukewarm water.

(*b*) Using a scrubbing-brush, wash thoroughly (both inside and outside where necessary) with warm water in which washing soda or other cleaner is dissolved.

(*c*) Near sterilize by immersion in boiling water or by steam. "Scalding," which is the usual final step on most farms, is only efficient if plenty of boiling water is used.

(*d*) Allow utensils to drain and dry in an inverted position on a metal draining rack situated in a dust-free atmosphere; if desired, the rack may be in a sunny position. Do not use a cloth to dry dairy utensils.

TO PRESERVE BUTTER.

Boil together for a quarter of an hour 4 quarts of water, 2 lb. salt, 1 oz. saltpetre, and 2 oz. white sugar. Skim well and allow this brine to get perfectly cold, put into an earthenware crock or small new keg, or a nice, clean benzine tin. To prepare the butter wash it until it is free from milk, work into it fine salt in the proportion of ½ oz. to every pound and see that all moisture is squeezed out, wrap each pound in a square of butter muslin and put into the brine from day to day as the butter is made, taking care that it is well covered. To ensure this place a plate on the top with a stone or a lump of lead which will prevent the butter floating.

If these instructions are carefully followed the butter will be quite sweet and good at the end of six months.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which have qualified for entry into the Advanced Register of the Herd Books of the A.I.S., Jersey, Ayrshire, and Guernsey Societies, production records for which have been compiled during the month of October, 1944 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
SENIOR, 3 YEARS (STANDARD 290 LB.).				
Jamberoo Modesty 13th	M. J. Brosnan, Clifton	8,431·75	361·84	Greyleigh Valiant
JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Fairlie Cherry 16th	S. J. Mitchell and Mulcahy, Warwick	7,449·83	268·916	Fairlie Senator
JERSEY.				
JUNIOR, 4 YEARS (STANDARD 310 LB.).				
Hocknell Waimate Creamery (365 days)	N. C. Webb, Beaudesert	10,631·65	600·738	Hocknell Golden Surprise
Strathdean Dora	S. H. Caldwell, Bell	5,525·75	355·964	Nauva Ladora's Ruler
SENIOR, 3 YEARS (STANDARD 290 LB.).				
Lermont Birdie	J. Schull, Oakey	6,615·2	336·36	Woodside Golden Volunteer
JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Strathdean Daffodil	S. H. Caldwell, Bell	6,175·39	392·189	Langside Pattibell's Dreamer 2nd
Trinity Lettie	F. Eager, Petrie	5,945·0	293·979	Samares Cute Prince 3rd (imp.)
SENIOR, 2 YEARS (STANDARD 250 LB.).				
Strathdean Fortune	S. H. Caldwell, Bell	5,375·46	340·077	Navua Ladora's Ruler
Lermont Charm	J. Schull, Oakey	6,083·6	288·856	Woodside Golden Volunteer
JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Lermont Molly	J. Schull, Oakey	5,874·35	298·478	Selsey Samara's Hallmark
AYRSHIRE.				
JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Leafmore Lynne Carver	J. P. Ruhle, Motley	7,139·05	258·12	Myola Bessemer
GUERNSEY.				
JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Laureldale Vera	W. A. K. Cooke, Witta	7,488·35	381·433	Minnamurra Topsy's Sequel 2nd

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production records for which have been compiled during the month of November, 1944 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
Mature Cow (Standard 350 lb.)				
Cedar Grove Mayflower 23rd	W. H. Sanderson, Mulgeldie	10,000·32	371·485	Cedar Grove Umpire
Junior, 4 Years (Standard 310 lb.).				
Fairvale Princess	J. H. Anderson, Southbrook	8,893·07	382·008	Corunna Supreme
Jamberoo Dignity 2nd	M. J. Brosnan, Clifton	9,657·5	369·351	Greyleigh Valiant
Senior, 2 Years (Standard 250 lb.).				
Sunlit Farm Ita 4th	W. H. Sanderson, Mulgeldie	6,447·76	253·608	Raleigh Nymbodia
JERSEY.				
Mature Cow (Standard 350 lb.).				
Windsor Lady Jeanette	Johnson Bros., Gleneagle	7,896	439·931	Brooklands Sultan's Victory
Junior, 4 Years (Standard 310 lb.).				
Westbrook Tulip 107th	Farm Home for Boys, Westbrook	9,144·2	495·827	Westbrook Ambassador 28th
Gem Lelia	W. Bishop, Kenmore	7,644·9	439·873	Calton Lothean
Senior, 3 Years (Standard 290 lb.).				
Westbrook Sylvia 7th	Farm Home for Boys, Westbrook	9,735·1	413·177	Oxford Aster's Lad
Trecarne Some Rosina	P. Schull, Oakey	5,203·35	292·099	Trecarne Some Duke
Junior, 3 Years (Standard 270 lb.).				
Westbrook Starbright	Farm Home for Boys, Westbrook	7,201·95	370·353	Oxford Aster's Lad
Senior, 2 Years (Standard 250 lb.).				
Gem Constance	W. Bishop, Kenmore	6,938·5	339·609	Bulby Oxford Gamboge
Gem Celia 2nd	W. Bishop, Kenmore	5,504·4	355·769	Bulby Oxford Gamboge
Junior, 2 Years (Standard 230 lb.).				
Glenview Gentle	W. Muller, Marburg	6,321·9	333·578	Trinity Royal Prince
GUERNSEY.				
Senior, 2 Years (Standard 250 lb.).				
Laureldale Maud	W. A. K. Cooke, Witta	5,173·25	259·862	Laureldale President

REGISTERED HATCHERIES

REGISTRATION of poultry hatcheries entails the blood testing of the poultry and the removal of birds found to be affected with pullorum disease, or are otherwise unsuitable for breeding purposes.

Hatchery owners who have applied for the registration or the removal of the registration of their hatcheries are listed hereunder:—

Owner.	Name of Hatchery.	Breeds.
N. W. Alfredson, Geebung street, Geebung	Selby	Australorps
V. H. Allen, Oxley road, Oxley	Alaura	White Leghorns, Australorps, Langshans, Rhode Island Reds
I. M. Armstrong, Randall road, Wynnum West	Chanticler	Australorps
A. J. Barnes, Handford road, Zillmere	Zillmere	White Leghorns, Australorps, and Langshans
J. S. Bauer, Oakwood, Bundaberg	Triangle	Australorps and White Leghorns
C. and M. Birney, Archerfield road, Darra	Evenley	White Leghorns and Australorps
R. H. Bowles, Glenmore road, North Rockhampton	Glen Stud	White Leghorns and Australorps
C. W. Bowtell, 4 Payne street, Toowoomba	Downs	Australorps and White Leghorns
John Bowtell, North street, Wilsonton, Toowoomba	Downs	White Leghorns, Brown Leghorns and Australorps
E. J. Brazier, 109 Bridge street, Toowoomba	Miamba	
H. Brazil, Beaudesert road, Eight Mile Plains	Brazil's	Australorps and White Leghorns
C. M. Bryce, Postal street, Oxley	Celny	Australorps, White Leghorns, Rhode Island Reds, Welsummer, and Minorcas
Percy J. C. Bygrave, Box 24, P.O., South Brisbane	Craigan Farm	White Leghorns and Australorps
J. Cameron, Oxley Central	Cameron's	Australorps and White Leghorns
W. Carr and **A. B.** and **A. T. M. Watson,** Logan and Creek roads, Mount Gravatt	Bellview Stud	Australorps and White Leghorns
J. L. Carrick and Son, Manly road, Tingalpa	Craigard	White Leghorns and Australorps
A. R. Chard, Chard's road, Bundaberg	Sunnyland	Australorps, White and Brown Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville	White Leghorns
R. B. Corbett, Woombye	Labrena	White Leghorns and Australorps
Alfred Cowley, The Gap, Ashgrove	Melody	White Leghorns
C. M. Cullinane, Upper Mount Gravatt	Rusholn	White Wyandottes and Australorps
V. R. Dearling, 85 Holberton street, Toowoomba	Downs	White Leghorns, Australorps, and Brown Leghorns
E. Eckert, Head street, Laidley	Laidley	Australorps, Langshans, and White Leghorns
Elks and Sudlow, Beerwah	Woodlands	White Leghorns and Australorps
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner	Australorps
W. Ellison, junr., Bald Knob, Landsborough	Willeden	White Leghorns
C. Erbacher, 75 Ramsay street, Toowoomba	Rhode Island Red	Australorps
L. D. Fraser, 69 Ramsay street, Toowoomba	Downs	Australorps
W. H. Gibson, Manly road, Tingalpa	Gibson's	White Leghorns and Australorps
Gisler Bros., Wynnum road, Wynnum	Gisler Bros.	White Leghorns and Australorps
H. J. Greer, Church road, Zillmere	Iona	White Leghorns and Australorps
W. G. Gregory, Deeragun, Ingham Line	Rocks Stud	White Leghorns, Australoprs, and Rhode Island Reds
F. P. Grillmeier, Milman	Mountain View	Minorcas and Australorps
T. A. Haggquist, Edmonton	White Rocks	
G. Hall, Kin Kin	Kin Kin	Australorps
P. Haseman, Stanley terrace, Taringa	Black and White	White Leghorns and Australorps
F. E. Hills, Sims road, Bundaberg	Littlemore	Rhode Island Red, Australorps White Leghorns, White Wyandottes, and Langshans
A. E. Hoopert, 24 Greenwattle street, Toowoomba	Kensingson Stud	Australorps and Rhode Island Reds
H. Hufschmid, Ellison road, Geebung	Meadowbank	White Leghorn, Brown Leghorns, Minorca, Australorps, and Rhode Island Reds
E. C. Knoblauch, Mount Gravatt	Lucinda Park	White Leghorns, Australorps, and Anconas
E. C. Kolberg, Handford road, Zillmere	Gerbera	Australorps
W. A. Lehfeldt, Kalapa	Lehfeldt's Australorp	Australorps

REGISTERED HATCHERIES—*continued.*

Owner.	Name of Hatchery.	Breeds.
W. A. Luke, 108 Russell street, Toowoomba	Downs	White Leghorns, Brown Leghorns, Australorps, and Rhode Island Reds
J. McCulloch, Whites road, Manly	Hindes Stud	White Leghorns, Brown Leghorns, and Australorps
W. S. MacDonald, Babinda	Redbird	Rhode Island Reds and Anconas
A. Malvine, Waterworks road, The Gap, Ashgrove	Alva	Australorps and White Leghorns
H. L. Marshall, Kenmore	Stonehenge	White Leghorns and Australorps
W. J. Martin, Pullenvale	Pennington	Australorps, White and Black Leghorns
A. Mawhinney, Robinson road, Aspley	Aspley	White Leghorns, Australorps, and Rhode Island Reds
C. Mengel, New Lindum road, Wynnum West	Mengel's	Australorps
D. G. Miller, Nerimbera, via Lakes Creek	Nerimbera	White Leghorns
E. C. Moore, Hyde road, Yeronga	Yeronga	Australorps and White Leghorns
C. J. Nielsen, Kensington street, Bundaberg	Bona Vista	Australorps, White Leghorns, and Rhode Island Reds
S. V. Norup, Beaudesert road, Cooper's Plains	Norup's	White Leghorns and Australorps
H. Obst and Sons, Shepperd	Collegeholme	White Leghorns and Rhode Island Reds
A. C. Pearce, Marlborough	Marlborough	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, Langshans, Khaki Campbell Ducks, Indian Runner Ducks, and Bronze Turkeys
P. A. Pearce, Paynes road, The Gap, Ashgrove	Berea	White Leghorns, Australorps, and Rhode Island Reds
W. J. Perkins, 110 Neil street, Toowoomba	Rhode Island Red	Rhode Island Reds
G. Pitt, Box 132, Bundaberg	Pitt Poultry Breeding Farms	White Wyandottes, White Leghorns, Brown Leghorns, Australorps, Rhode Island Reds, Langshans, and Light Sussex
J. C. and **G. E. Raff**, Musgrave road, Sunnybank	Brundholme	White Leghorns, Australorps, and Rhode Island Reds
G. R. Rawson and Son, Upper Mount Gravatt	Rawsons'	Australorps
J. Richards, P.O., Atherton	Mountain View	Leghorns and Australorps
J. Rogoff, Woodridge	Kingston road	Australorps
C. L. Schlencker, Handford road, Zillmere	Windyridge	White Leghorns
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa Stud	White Leghorns and Australorps
N. G. Seymour, Palm Avenue, Sandgate	Sohufa	Australorps, Black Leghorns, and White Leghorns
J. Schumann, 291 Bridge street, Toowoomba	Downs	White Leghorns, Brown Leghorns, Rhode Island Reds, and Australorps
W. B. Slawson, Mitchelton	Kupidabin	White Leghorns, Australorps, and Light Sussex
T. Smith, Isis Junction	Fairview	White Leghorns and Australorps
H. A. Springall, Progress street, Tingalpa	Springfield	White Leghorns
A. Stehn and Son, 285 West street, Toowoomba	Red Spot	Australorps, Rhode Island Reds, White Leghorns, and Brown Leghorns
R. Stockman, Kairi	Tinaroo	White Leghorns and Rhode Island Reds
R. Taylor and **H. Cuerel**, 370 Montague road, Hill End	Bel-Air	Australorps and White Leghorns
E. G. Thorpe, Box 36, Goomeri	Thorburn Electric	White Leghorns, Australorps, and Rhode Island Reds
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkins'	White Leghorns, Australorps, and Rhode Island Reds
J. R. Twigg, Crown street, Geebung	Piccadilly	White Leghorns, Australorps, and Langshans
G. A. C. Weaver, Herberton road, Atherton	Weavers'	Australorps, White and Brown Leghorns, Anconas, Minorcas, Rhode Island Red, Indian Game, and Bantam
F. H. J. Weeks, Bajool	Glen Brae	White Leghorns and Australorps
Mrs. V. M. White, Archerfield road, Darra	Viola	White Leghorns and Australorps
Mrs. L. M. Wooller, Huet street, Rockhampton	Riverview	White Leghorns and Australorps
E. M. Winter, 5 Rose street, Toowoomba	Downs	White Leghorns
P. A. Wright, Laidley	Chillowdeane	White Leghorns, Brown Leghorns, and Australorps

How to Make a Pig Net.

E. J. SHELTON, Senior Instructor in Pig Raising.

BECAUSE of the present shortage of pig nets, the information in these notes should be useful to farmers who cart their own pigs to the saleyards or trucking stations, or who supply direct to factories. To those who are not experienced in the making of a pig-net mesh, it is suggested they get in touch with a camouflage net maker whose nets are made on exactly the same lines as a pig or calf net.

When transporting pigs in an open wagon or truck, a net or cover is required. The net illustrated is the type usually recommended for the purpose. It is convenient to use, cheap, durable, and easy to make.

It is not a sunshade, however, and there remains the necessity of providing some form of shade or protection, even if only a few green bushes or a wet bag or two.

The method of making a pig-net is simple. The materials required are rope and a length of softwood or hardwood board rounded at the edges and 12 to 18 inches long and of the same width at both ends. This piece of board is referred to by net makers as the mesh stick, its principal use being to keep all the meshes the same size. In actual use a mesh stick 2 inches wide will make a 4-inch mesh; a 3-inch stick a 6-inch mesh, &c. The object is to have the stick half the width of the mesh it is intended the net shall carry.

In measuring the meshes it is necessary to draw them out to a diamond shape. The 4-inch mesh is preferable for bacon or pork pigs, a smaller mesh for suckers and weaners. Where fishermen set out to fashion a fishing net they use a long needle and the cord is held on a reel or short length of timber, but with a pig-net the rope should first be rolled in the same way as the ordinary rope clothes-line or sash cord is when purchased; it will then be a simple matter to pass the hank of rope through the loops when making the knots at the corner of each mesh, for the knotting is done rapidly by an experienced worker.

In setting out to make the net, first tie a loop in one end of the rope as in A, Fig. 1. Place this knot on a strong spike or hook attached to a post or wall or some other convenient place as at A in Fig. 2. Now place the mesh stick under the loop as at B, put the rope around the mesh stick, then pass the rope through the loop and pull the rope tight, proceeding to place the thumb of the left hand on the rope beyond the loop as at A in Fig. 3, and with a turn of the wrist of the right hand throw the rope to the position shown at B. Next pass the rope behind the loop C, and then through the bight of B and down as at D; draw knot tight, which should now assume the shape indicated in Fig. 4. This figure shows the knot made loosely to enable the method of making it to be clearly seen. The rope should be held firmly with the thumb at A, Fig 3, when pulling up the knot, for on this depends the uniformity of the shape and size of mesh.

To continue the netting, the stick is withdrawn and placed under A, Fig. 4. The rope is then passed around the stick as in Fig. 2 and brought through the loop A, Fig. 4, and the process shown in Fig. 3 is repeated to form another mesh, this being continued to make a chain of meshes, say, the width of the conveyance to be used when transporting the pigs to rail or sale. The loop A, Figs. 1, 2, and 5, first tied is then untied and it will be found that all the meshes are equal in size. Next, the chain of meshes is opened out at right angles to the line in which it was made, as shown in Fig. 6; in other words, remove the chain of meshes from a vertical position as in Fig. 5 and place them in a horizontal position as in Fig. 6. A line is run through the meshes D, E, F, G, and secured between two posts to hold the net while continuing the meshing. Working across is then begun by making a mesh at A, Fig. 6, then at B, C, and so on until the length of the first lot of meshes has been reached, when the right-hand side of the net is turned around and placed where the left-hand side was and the left-hand side placed where the right-hand side was. Another row of meshes is started on the left-hand side (facing the net) and worked until the one under A has been reached on the right-hand side.

The net is turned again, and another row of meshes commenced on the left-hand side, and so on until there are enough rows of meshes to cover the vehicle. To secure the net to the vehicle use rope plough lines, and reeve them through each mesh and around the side and end rails of the body of cart. The method described of making the meshes is the same as is used in making ordinary hammocks.

The net and bags used for shade should be at least 1 foot above the backs of the pigs, otherwise the net may rub and injure them. Every care and attention should be given to prevent this happening.

In loading, secure the net on both sides and in front, first leaving a good length of plough rein free to tie net to rail of the tailboard when pigs are loaded and vehicle is clear of the loading race.

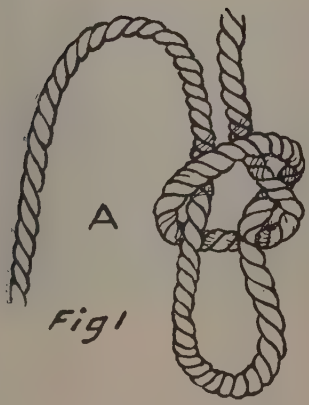


Fig 1

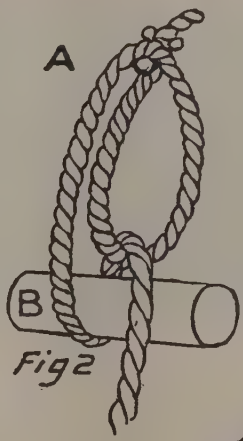


Fig 2

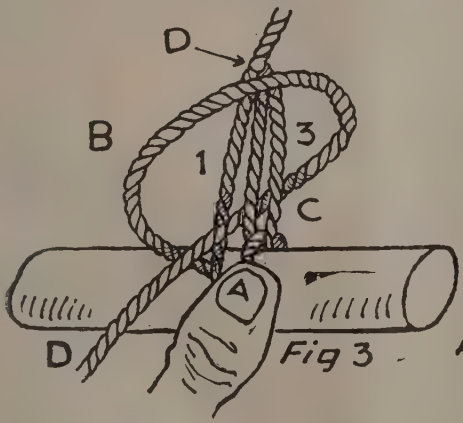


Fig 3

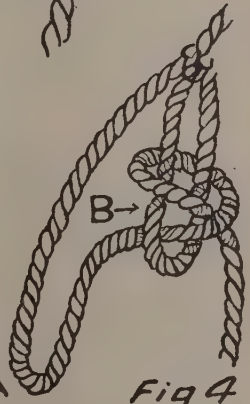


Fig 4

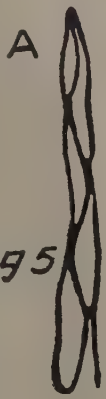


Fig 5

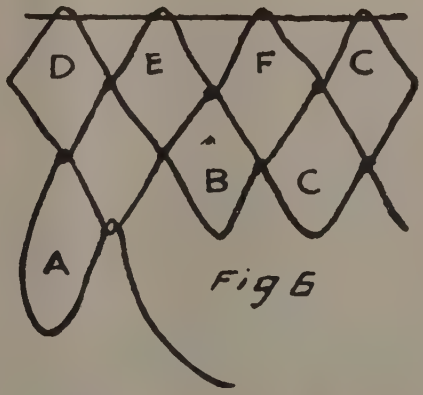


Fig 6

Plate 26.

Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

THE CARE OF CHILDREN'S TEETH.

THE building of a tooth has been likened to the building of a house. Skilled workmen (body cells functioning correctly) using the best materials (the right food) will produce a perfect tooth on ideal foundations (sound, healthy gums), while poor workmen using poor and substitute materials will produce a "jerry built" tooth with faulty foundations.

The building of a baby's teeth begins long before he is born—in about the second month of pregnancy, and his first set of teeth is handed over to him on his birthday, practically ready made—built for him out of his mother's blood. They cannot be seen because they are still in the gums, but they are all there and no care after birth can affect very much the structure of those first teeth.

Like the rest of his body the baby's teeth are built up from the food eaten—first by his mother and then by himself. Teeth are composed very largely of two minerals, lime and phosphorus, and so the diet of the expectant mother must contain a sufficient quantity of foodstuffs in which these minerals are found. The chief of these are milk, cheese, green leafy vegetables, eggs and whole grain cereals like oatmeal and wheatmeal. This diet also supplies Vitamins A, D, and C, which are also necessary for dental health. Added to the correct diet the expectant mother should follow all the rules for healthy living, including plenty of fresh air and sunshine and supervision of her own teeth by a qualified dentist. If parents attend carefully to these matters, then baby should start life with a good set of teeth.

Parents should then consider how they can ensure the preservation of their baby's teeth. This involves care under three headings: (1) the right kind of food (building materials), (2) the way in which that food is taken, (3) dental care and supervision.

The correct food for the baby in his first months is obviously his own mother's milk, partly because it contains the right amount of lime and phorphorus for building purposes and partly because the strong sucking action the baby uses to obtain this food develops and strengthens the jaws as bottle feeding can never do. The fine wide dental arches of the efficiently breast-fed child, and its well-spaced teeth at the age of five or six years, are well known evidence of this. If bottle-feeding has to be resorted to, it should be under the supervision of a physician and nurse specially trained in infant welfare.

The baby's teeth commence to come through from about seven months of age and, while this is happening, the second teeth are gradually developing behind them in the gums. The first teeth of the second set come through at six years. Civilised people seem to have forgotten that teeth are specially designed for hard chewing and they continue to feed the baby with soft pappy meals long after he should be

learning to use his teeth on crisp food. A smooth-scraped bone at five months and a rusk or twice-baked bread at seven months teach the baby to bite and chew; thereafter he needs hard food every day to keep his teeth healthy and widen and develop his jaws to make room for the second teeth. The diet of the growing child should contain the essential foods advised for the expectant mother with the addition of hard crusts, toast, apples, raw carrot and other suitable foods for jaw exercise. Besides giving the correct foods, it is necessary to avoid those which are the enemies of teeth—principally refined sugars and starches.

Once the baby has erupted all his first or temporary teeth at two years of age, these should be watched with the greatest care, because they are the path finders for the permanent set, and if they are lost they cannot guide the permanent teeth into their proper places. So the help of the dentist should be sought to watch over them.

Every child should begin going to the dentist when three years of age, and between five and seven years of age he should visit the dentist every three months in order that any damage may be repaired before it becomes serious. Children should be taught to regard the dentist as a friend who helps them to keep their teeth nice and they will have no trouble.

A correctly shaped tooth brush and regular tooth drill completes the order of the care of teeth. Children should not be ashamed to smile.

Questions on this or any other subject concerning maternal and child welfare will be answered by communicating personally with the *Maternal and Child Welfare Information Bureau*, 184 St. Paul's Terrace, Brisbane, or by addressing letters *"Baby Clinic, Brisbane."* These letters need not be stamped.

IN THE FARM KITCHEN.

Some Summer Salads.

Tomatoes with chopped parsley and young onions.

Tomatoes (small) peeled and quartered, with diced cucumber, pieces of cheese, hearts of lettuce, moulded spinach, diced beetroot, and sliced egg.

Diced cold boiled potatoes, finely-chopped onion, chopped celery, salt.

Chopped tomato, cucumber, cooked sweet bread (any white meat may be used instead), salt, pepper, with dressing.

A Way of Serving Tomatoes.—Cut in halves and put together again with a layer of cream cheese, seasoned and moistened with salad dressing. Top with a sprig of parsley.

Banana, beetroot, cucumber, grated nut, and lettuce.

Orange, tomato, beetroot in mayonnaise jelly; serve on lettuce.

Pineapple, tomato, cheese in mayonnaise jelly; serve on lettuce.

Apple, celery, parsley, walnut, on lettuce.

Beetroot and green peas in mint jelly.

Combination Salad.—Tomato wedges, sliced cucumber, onion rings; sprinkle with vinegar and let stand for some hours; serve on lettuce with French dressing.

Green Vegetable Salad.—Cooked string beans and peas, diced cucumber, minced onion; sprinkle with vinegar and let stand for some hours; serve on lettuce with French dressing.

Chiffonade Salad.—Cubes of cooked beetroot, sliced hard-boiled eggs, minced onion; sprinkle with vinegar and let stand for some hours; serve on lettuce with mayonnaise.

Carrot and Cabbage Slaw.—New carrots, cut in long fine strips; cabbage finely shredded mixed with vinegar; combine carrots and cabbage by tossing together lightly with salad dressing; serve thoroughly chilled.

Golden Glow Salad.—Diced pineapple, grated raw carrot, grated nut; on lettuce with mayonnaise.

Other salads.—Macaroni, sliced egg and minced onion; served on lettuce.

Baked apples, served with nuts and raisins on lettuce, garnished with currant jelly and mayonnaise.

Celery, cheese, and pineapple on lettuce; serve with dressing.

ASTRONOMICAL DATA FOR QUEENSLAND.

JANUARY.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			CORRECTION IN MINUTES FOR OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4·56	6·46	Cairns	+ 48	+ 10	Longreach ..	+ 43	+ 27
6	5.00	6.47	Charleville ..	+ 29	+ 25	Quilpie	+ 33	+ 37
11	5.04	6.47	Cloncurry ..	+ 63	+ 37	Rockhampton ..	+ 18	+ 2
16	5.08	6.47	Cunnamulla ..	+ 28	+ 30	Roma	+ 19	+ 15
21	5.12	6.46	Dirranbandi ..	+ 17	+ 21	Townsville.. ..	+ 40	+ 10
26	5.16	6.45	Emerald	+ 27	+ 12	Winton	+ 50	+ 30
31	5.20	6.43	Hughenden ..	+ 47	+ 23	Warwick	+ 2	+ 5

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	p.m.	a.m.
1	8.57	7.03
2	9.38	7.59
3	10.14	8.54
4	10.48	9.47
5	11.20	10.39
6	11.51	11.31
		p.m.
7	..	12.22
	a.m.	
8	12.22	1.14
9	12.55	2.08
10	1.31	3.03
11	2.12	4.00
12	2.57	4.59
13	3.48	5.57
14	4.45	6.53
15	5.46	7.46
16	6.51	8.34
17	7.56	9.18
18	9.01	10.00
19	10.05	10.39
20	11.08	11.18
	p.m.	
21	12.10	11.57
22	1.12	..
		a.m.
23	2.14	12.38
24	3.15	1.22
25	4.15	2.09
26	5.12	3.01
27	6.04	3.55
28	6.51	4.52
29	7.33	5.48
30	8.11	6.44
31	8.46	7.38

CORRECTION IN MINUTES FOR SOUTHERN DISTRICTS.

Charleville + 27; Cunnamulla + 29; Dirranbandi + 19; Quilpie + 35; Roma + 17; Warwick + 4.

CORRECTIONS IN MINUTES FOR CENTRAL DISTRICT.

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	+ 12	+ 27	+ 28	+ 42	+ 2	+ 17	+ 31	+ 49
6	+ 19	+ 20	+ 36	+ 35	+ 11	+ 10	+ 41	+ 40
11	+ 26	+ 13	+ 42	+ 28	+ 17	+ 3	+ 49	+ 32
16	+ 26	+ 13	+ 42	+ 29	+ 17	+ 4	+ 49	+ 33
21	+ 16	+ 23	+ 33	+ 39	+ 7	+ 14	+ 36	+ 44
26	+ 11	+ 28	+ 27	+ 43	+ 1	+ 18	+ 30	+ 50
31	+ 15	+ 24	+ 31	+ 40	+ 6	+ 15	+ 35	+ 45

CORRECTIONS IN MINUTES FOR NORTHERN DISTRICTS.

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	+ 12	+ 47	+ 39	+ 62	+ 24	+ 47	+ 11	+ 39
3	+ 18	+ 41	+ 43	+ 59	+ 29	+ 44	+ 16	+ 35
5	+ 26	+ 33	+ 47	+ 54	+ 33	+ 38	+ 22	+ 29
7	+ 34	+ 25	+ 53	+ 47	+ 39	+ 32	+ 30	+ 22
9	+ 38	+ 17	+ 56	+ 42	+ 41	+ 27	+ 33	+ 15
11	+ 45	+ 13	+ 61	+ 39	+ 46	+ 25	+ 38	+ 13
13	+ 48	+ 11	+ 64	+ 38	+ 48	+ 23	+ 41	+ 11
15	+ 48	+ 10	+ 64	+ 37	+ 48	+ 23	+ 41	+ 10
17	+ 42	+ 18	+ 58	+ 43	+ 43	+ 28	+ 36	+ 16
19	+ 32	+ 28	+ 53	+ 50	+ 38	+ 35	+ 29	+ 24
21	+ 22	+ 38	+ 46	+ 56	+ 31	+ 41	+ 20	+ 32
23	+ 14	+ 41	+ 41	+ 59	+ 27	+ 44	+ 14	+ 36
25	+ 9	+ 48	+ 37	+ 62	+ 22	+ 47	+ 9	+ 40
27	+ 9	+ 49	+ 37	+ 63	+ 22	+ 48	+ 8	+ 41
29	+ 14	+ 46	+ 40	+ 62	+ 25	+ 47	+ 12	+ 39
31	+ 21	+ 38	+ 44	+ 57	+ 30	+ 42	+ 18	+ 34

NOTE.—The plus sign (+) means later than Brisbane time.

PHASES OF THE MOON.

Last Quarter, 6th January, 10.47 p.m.; New Moon, 14th January, 3.06 p.m.; First Quarter, 21st January, 9.48 a.m.; Full Moon, 28th January, 2.41 p.m.

DISCUSSION.

On 20th January the Sun will rise and set 20 degrees south of true east and true west respectively. On 6th January the Moon will rise and set, respectively, almost true east and true west.

Venus.—This planet at the beginning of the month, in the constellation of Aquarius, will set, from Queensland generally, between 9.30 p.m. and 10.15 p.m., 15 degrees south of true west. By the end of the month it will have reached the constellation of Pisces and will set between 9 p.m. and 9.45 p.m., almost true west.

Mars.—Still too near in line with the Sun for observation.

Jupiter.—In the constellation of Virgo, Jupiter at the beginning of the month will rise between 11 p.m. and 11.45 p.m. 2 degrees north of east. At the end of the month it will rise between 9 p.m. and 9.45 p.m. 2 degrees north of east.

Saturn.—At the beginning of the month Saturn will rise about 6 p.m. 23 degrees north of true east and will set about daybreak. By the end of the month this planet will rise during the afternoon and will set between 2.45 a.m. and 3.45 a.m. 23 degrees north of true west.

ANNULAR ECLIPSE OF SUN—14TH JANUARY.

A solar eclipse occurs at New Moon and when the centres of the earth, Moon, and Sun are in a straight line, or nearly so. If the Moon moved in its orbit in exactly the same plane as the orbit of the earth, there would be an eclipse of the Sun every New Moon, and also an eclipse of the Moon every Full Moon. The Moon's orbit, however, is inclined at about 5 degrees to the orbit of the earth, and we have a solar eclipse only at the New Moon which occurs when the Moon, in its orbit, approaches the plane of the earth's orbit, the Moon passing between the earth and the Sun and blotting out portion, or the whole, of the Sun from view. At Aphelion, the maximum distance of the Sun from the earth—94,600,000 miles—the Sun's angular diameter is 31 minutes 30.72 seconds, and at Perihelion the minimum distance of the Sun from earth—91,400,000 miles—the Sun's angular diameter is 32 minutes 35.10 seconds. The Moon at maximum distance, known as apogee (252,700 miles), has an angular diameter of 29 minutes 23 seconds and at minimum distance, known as perigee (221,900 miles), has an angular diameter of 33 minutes 27 seconds. It will be seen that depending on the distances of the Sun and Moon from the earth, sometimes the disc of the Moon appears larger than the disc of the Sun and sometimes smaller. There are thus three kinds of solar eclipses:—(1) Annular eclipse, which occurs when the centres of the Sun and Moon are in line with the observer, but the disc of the Moon appears smaller than the disc of the Sun and only the centre of the Sun is obscured, leaving a ring of light round the Moon. (2) Total eclipse, which occurs when the centres of the Sun and Moon are in line with the observer, but the disc of the Moon appears larger than the disc of the Sun completely obscuring the Sun. (3) Partial eclipse, which occurs when the centres of the Sun and Moon are not exactly in line with the observer and the Moon covers up only a portion at one side of the Sun's disc, leaving an illuminated crescent. A solar eclipse, unlike a lunar eclipse, is only visible over a part of the earth's surface and its circumstances are different at different places. As the Sun and Moon move forward in their respective orbits, and the earth revolves on its axis, the different phases of the eclipse become visible from different places in succession. Total and annular eclipses appear from only narrow paths on the earth's surface—the maximum width being about 180 miles for a total eclipse and about 230 miles for an annular one, while the maximum duration of totality is about 8 minutes and of annular phase about 12 minutes. Partial eclipses, however, are visible from a very wide area and may last as long as several hours. Every annular and total eclipse begins and ends as a partial one, and from over 2,000 miles on either side of the path of totality or annular phase the eclipse is viewed as a partial one

On 14th January (Australian date) an annular eclipse will be observed from a path commencing in Cape Province, British South Africa, and stretching across the Indian Ocean just north of Kerguelen Islands, across the extreme north-west corner of Tasmania, through Bass Straight, and ending in the Pacific Ocean north of New Zealand. The width of this path will vary from 52 miles to 8 miles, and the longest duration of annular phase at any particular place will be 53 seconds. At the middle of the eclipse the angular diameter of the Sun will be 34.6 seconds greater than the angular diameter of the Moon, and if a circle 1 inch in diameter be drawn to represent the Sun the Moon will then be represented by a circle nine-tenths inch in diameter. Southern Queenslanders, though not being fortunate enough to view the annular phase of this eclipse, will, weather permitting, see the Moon's disc reach three-quarters of the way across the disc of the Sun. As we go north the area of the darkened portion diminishes, and from Central Queensland the Moon's disc will extend half-way across the Sun. At Cape York only about one-fifth of the Sun's diameter will be obscured. Those in the south-west corner of the State will observe the eclipse first, the beginning there being about 3.10 p.m.. The time of commencement in the central-west and south-eastern part of the State will be between 3.10 and 3.20 p.m., and from Northern Queensland between 3.20 and 3.45 p.m. From all places in Queensland the eclipse will end before sunset, the duration of the eclipse being from one and a-half hours in the northern portion of the State to two and a-half hours in the southern portion.

It is exceedingly dangerous to attempt to view the Sun without some protection for the eyes. A heavily-smoked piece of glass will serve the purpose.

Supplied by the Astronomical Society of Queensland.

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ASTRONOMICAL DATA FOR QUEENSLAND.

FEBRUARY.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			CORRECTION IN MINUTES FOR OTHER PLACES					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.21	6.42	Cairns	+ 41	+ 16	Longreach ..	+ 40	+ 30
6	5.24	6.40	Charleville ..	+ 29	+ 25	Quilpie	+ 34	+ 36
11	5.28	6.36	Cloncurry ..	+ 57	+ 42	Rockhampton ..	+ 15	+ 5
16	5.32	6.32	Cunnamulla ..	+ 28	+ 30	Roma	+ 18	+ 16
21	5.35	6.28	Dirranbandi ..	+ 18	+ 20	Townsville	+ 34	+ 16
26	5.38	6.23	Emerald	+ 24	+ 14	Winton	+ 46	+ 34
28	5.39	6.21	Hughenden ..	+ 42	+ 27	Warwick	+ 4	+ 4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	p.m.	a.m.
1	9.18	8.31
2	9.50	9.22
3	10.21	10.13
4	10.53	11.04
5	11.27	11.56
		p.m.
6	..	12.50
	a.m.	
7	12.05	1.45
8	12.47	2.42
9	1.34	3.40
10	2.27	4.37
11	3.27	5.32
12	4.31	6.23
13	5.37	7.10
14	6.44	7.54
15	7.51	8.35
16	8.56	9.15
17	10.01	9.56
18	11.05	10.37
	p.m.	
19	12.08	11.20
20	1.10	..
		a.m.
21	2.10	12.07
22	3.07	12.57
23	4.00	1.50
24	4.47	2.45
25	5.31	3.41
26	6.10	4.36
27	6.45	5.31
28	7.18	6.23

CORRECTION IN MINUTES FOR SOUTHERN DISTRICTS

Charleville + 27; Cunnamulla + 29; Dirranbandi + 19;
Quilpie + 35; Roma + 17; Warwick + 4.

CORRECTIONS IN MINUTES FOR CENTRAL DISTRICT.

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	+ 17	+ 22	+ 33	+ 38	+ 8	+ 13	+ 37	+ 44
6	+ 25	+ 14	+ 42	+ 29	+ 16	+ 4	+ 48	+ 33
11	+ 28	+ 12	+ 44	+ 27	+ 19	+ 2	+ 51	+ 30
16	+ 19	+ 20	+ 35	+ 36	+ 10	+ 11	+ 40	+ 42
21	+ 12	+ 27	+ 27	+ 42	+ 2	+ 18	+ 30	+ 50
26	+ 14	+ 25	+ 29	+ 41	+ 4	+ 17	+ 33	+ 49
28	+ 17	+ 23	+ 32	+ 39	+ 8	+ 14	+ 37	+ 44

CORRECTIONS IN MINUTES FOR NORTHERN DISTRICTS.

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	+ 24	+ 36	+ 47	+ 55	+ 32	+ 40	+ 21	+ 30
3	+ 32	+ 27	+ 52	+ 48	+ 37	+ 33	+ 27	+ 23
5	+ 41	+ 18	+ 57	+ 43	+ 42	+ 28	+ 34	+ 17
7	+ 47	+ 10	+ 62	+ 38	+ 47	+ 23	+ 38	+ 11
9	+ 49	+ 7	+ 63	+ 36	+ 48	+ 21	+ 40	+ 8
11	+ 50	+ 8	+ 64	+ 36	+ 48	+ 22	+ 41	+ 9
13	+ 44	+ 15	+ 60	+ 41	+ 45	+ 26	+ 36	+ 15
15	+ 34	+ 26	+ 54	+ 47	+ 38	+ 33	+ 29	+ 22
17	+ 23	+ 36	+ 46	+ 55	+ 31	+ 40	+ 21	+ 31
19	+ 14	+ 44	+ 41	+ 60	+ 26	+ 46	+ 14	+ 37
21	+ 9	+ 47	+ 37	+ 62	+ 22	+ 47	+ 9	+ 39
23	+ 8	+ 49	+ 37	+ 63	+ 21	+ 49	+ 8	+ 41
25	+ 12	+ 47	+ 39	+ 62	+ 24	+ 47	+ 12	+ 39
28	+ 23	+ 37	+ 46	+ 56	+ 31	+ 41	+ 21	+ 32

NOTE.—The plus sign (+) means later than Brisbane time.

PHASES OF THE MOON.

Last Quarter, February 5th, 5.55 p.m.; New Moon, February 13th, 3.33 a.m.; First Quarter, February 19th, 6.38 p.m.; Full Moon, February 27th, 10.07 a.m.

DISCUSSION.

On February 25th the Sun rises and sets 10 degrees south of true east and true west, respectively.

On February 16th the Moon rises true east.

Venus.—Venus at the beginning of February, in the constellation of Pisces, sets, from Queensland generally, between 9 p.m. and 9.50 p.m., almost true west. By the end of the month, still in the constellation of Pisces, it sets, generally, between 8.15 p.m. and 9 o'clock, 14 degrees north of true west.

Mars.—Although still close in line with the Sun, Mars may be observed in the early part of the month in the constellation of Sagittarius, low in the east during morning twilight, and rising in Queensland from 3.30 a.m. to 4.15 a.m., 24 degrees south of true east. By the end of the month it will have passed into the constellation of Capricornus, rising from 3.20 a.m. to 4 a.m., 20 degrees south of true east.

Jupiter.—In the constellation of Virgo, Jupiter at the beginning of this month rises after 9 p.m., 3 degrees north of true east. By the end of the month it rises soon after sunset 4 degrees north of east and will be seen low in the west during morning twilight.

Saturn.—This planet rises during the afternoon and sets soon after midnight, 24 degrees north of true west. It is still within the constellation of Gemini.

OUR SOLAR SYSTEM.

Astronomy, as with all sciences, carries many terms the meaning of which, while clear to those who have made a study of the subject, when used in discussions for general reading, convey nothing to the majority of readers. The writer then has to choose between using the terms and trusting to luck they are understood, or try to avoid their use, or if that cannot be done, add lengthy explanations. Often in adopting the latter course the subject of discussion, especially when space is limited, is lost in this explanation of technical terms. Generally, too, it is found there is confusion with respect to the movements, or apparent movements, of the heavenly bodies, and complete lack of understanding of the position our solar system occupies in relation to the stars. So, then, before proceeding to discuss further items of astronomical interest, by the use of simple illustrations it is hoped to give readers a clear understanding of these problems and in doing so to consider the common terms met with in this science.

The first thing to impress is the immensity of space, and, compared with the distance of the stars, the distances between us and the Sun, Moon, and other planets are very, very small. Our Solar system is composed of the Sun, and, so far as is known, 9 planets which all move round the Sun in the same direction. The mean distances of these planets from the Sun, in miles, are as follows:—Mercury, 36,000,000; Venus, 67,200,000; Earth, 93,000,000; Mars, 141,500,000; Jupiter, 483,300,000; Saturn, 886,100,000; Uranus, 1,783,000,000; Neptune, 2,793,000,000; and Pluto, 3,666,000,000. The distance of the nearest star is 25,000,000,000,000 (25 million million) miles, or nearly 270,000 times greater than the distance of the Earth from the Sun. The distance of the other stars are many more million millions of miles away. The diameters of members of the Solar system, in miles, are:—The Sun, 864,000; Mercury, 3,000; Venus, 7,600; Earth, 7,900; Mars, 4,200; Jupiter, 86,000; Saturn, 71,000; Uranus, 30,900; Neptune, 33,000. The diameter of Pluto is still unknown. All these planets while moving round the Sun, called revolution in orbit, also spin like a top, called axial rotation (a top while spinning on the hand can also be carried round a room). The sun, too, spins like a top, and, measured according to our calendar, makes one complete turn in about 4 weeks. Mercury takes 88 days to complete one revolution round the Sun, and in the same time makes one complete turn on its axis, so that Mercury always turns the same face to the Sun. Venus, too, is thought to make one turn on its axis in the same time as it takes to go round the Sun—nearly 225 days. It is well known that the Earth takes 365¼ days to make one revolution in its orbit and that its period of axial rotation is one turn in nearly 24 hours (23 hours 56 mins. 04.10 secs). The axial rotation of Mars is a little slower than that of the earth, being one turn in 24 hours 37½ minutes, and it takes Mars nearly 2 years to go round the Sun once. Jupiter spins once on its axis in about 10 hours, and makes one revolution round the Sun in nearly 12 years. Saturn and Uranus also make one complete axial spin in about 10 hours, Saturn having an orbital revolutionary period of nearly 29½ years, and Uranus about 84 years. Neptune makes one revolution in its orbit in nearly 165 years and its period of axial rotation is thought to be about 15 hours for one turn.

Supplied by the Astronomical Society of Queensland.

QUEENSLAND WEATHER IN DECEMBER.

Seasonal thunderstorm rains in many parts of the State with the usual variability in district location and volume. The best distribution commenced in the north-west and central interior on 17th and 18th, passing to eastern districts on the 19th and 20th. Most of the tropical region had over-aggregate monthly falls, ranging from four inches in the central lowlands and highlands to monsoonal storms of over 13 inches in the Peninsula North, while several stations around the Atherton Plateau averaged over 10 inches. East Darling Downs and South Coast areas had from 2½ inches to 4½ inches. The pastoral and agricultural outlook in the benefited areas is average or good, but in the southern interior from the far South-West to the West Downs, especially the Warrego and Maranoa, general rains were urgently required to relieve drought conditions intensified by a heat wave. Many localities in these districts missed the good rains of last February and any temporary benefits of the light July and August falls have long since disappeared.

Temperatures.—Maximum temperatures ranged from, approximately, 2.5 deg. below normal at Boulia to 3.2 deg. above at Mitchell. Most tropical stations were somewhat under average. Minimum temperatures were round about normal except in the tropical interior —Boulia 0.5 deg. above and Longreach 3.1 deg. Heat spells occurred, particularly first and last weeks, with highest daily readings of 110 deg. at Longreach and Thargomindah on the 6th and 7th and Windorah and Quilpie on the 29th. Days over 100 deg., Longreach and Windorah 16, Winton and Quilpie 18.

Division.	Normal Mean.	Mean December 1944.	Departure from Normal.
	Points.	Points.	Per cent.
Peninsula North	702	1,352	93 above
Peninsula South	605	549	9 below
Lower Carpentaria	392	387	1 ,,
Upper Carpentaria	377	621	65 above
North Coast, Barron	690	624	10 below
North Coast, Herbert	690	462	33 ,,
Central Coast, East	454	387	15 ,,
Central Coast, West	333	645	94 above
Central Highlands	316	396	25 ,,
Central Lowlands	221	410	86 ,,
Upper Western	184	354	92 ,,
Lower Western	137	176	28 ,,
South Coast, Port Curtis	455	457	...
South Coast, Moreton	509	392	23 below
Darling Downs East	351	255	27 ,,
Darling Downs West	277	103	63 ,,
Maranoa	258	118	54 ,,
Warrego	215	60	72 ,,
Far South-West	155	63	59 ,,

Commonwealth Meteorological Bureau, Brisbane.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

NOVEMBER RAINFALL.

(Compiled from Telegraphic Reports).

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of years' records.	Nov., 1944.	Nov., 1943.		Nov.	No. of years' records.	Nov., 1944.	Nov., 1943.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	2·60	42	0·60	0·79	Gatton College	2·87	44	2·99	3·26
Cairns	3·81	61	1·14	2·09	Gayndah	2·97	72	0·57	3·13
Cardwell	4·14	71	0·25	5·09	Gympie	3·33	73	2·86	4·90
Cooktown	2·45	67	0·02	1·51	Kilkivan	2·66	62	3·31	2·48
Herberton	2·68	57	0·48	2·08	Maryborough	3·20	72	3·76	4·88
Ingham	3·75	51	0·07	0·99	Nambour	4·21	47	3·33	2·35
Innisfail	6·25	62	0·62	7·93	Nanango	2·86	61	1·38	2·91
Mossman	5·75	19	0·89	3·06	Rockhampton	2·48	72	0·86	0·55
Townsville	1·87	72	0·28	1·66	Woodford	3·29	55	3·38	4·32
Central Coast.					*Central Highlands.*				
Ayr	1·67	56	..	0·60	Clermont	2·15	72	0·07	2·03
Bowen	1·24	72	0·48	0·22	Springsure	2·39	74	2·40	3·40
Charters Towers	1·43	61	..	0·09					
Mackay	3·05	72	0·59	0·70	*Darling Downs.*				
Proserpine	2·82	40	0·07	1·06	Dalby	2·80	73	3·08	6·30
St. Lawrence	2·40	72	0·18	2·01	Emu Vale	2·81	47	1·70	4·03
					Jimbour	2·50	64	1·30	6·40
South Coast.					Miles	2·58	58	0·67	5·13
Biggenden	2·90	44	1·33	2·23	Stanthorpe	2·76	70	2·04	4·53
Bundaberg	2·79	60	1·88	3·67	Toowoomba	3·33	71	2·49	5·82
Brisbane Bureau	3·74	91	3·77	6·85	Warwick	2·66	78	1·86	4·40
Caboolture	3·51	67	7·08	4·37					
Childers	2·81	48	1·35	2·78	*Maranoa.*				
Crohamhurst	4·55	50	5·23	3·40	St. George	1·75	62	0·21	1·19
Esk	3·25	56	2·93	1·69	Roma	2·17	69	0·65	3·94

CLIMATOLOGICAL TABLE FOR NOVEMBER.

Compiled from Telegraphic Reports.

Divisions and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.		Extremes of Shade Temperature.				Rainfall.	
		Mean Max.	Mean Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cairns	..	85	70	91	26, 30	61	7	114	6
Herberton	..	82	59	91	8	51	7	48	5
Townsville	..	86	72	93	9	62	4	28	3
Brisbane	29·97	83	65	94	20	57	1	377	9
Darling Downs.									
Dalby	..	91	62	105	18, 19, 20	46	9	308	6
Stanthorpe	..	83	53	99	18, 19, 20	39	9	204	7
Toowoomba	..	83	60	101	20	51	1, 2	249	11
Mid-Interior.									
Georgetown	29·87	99	70	104	11, 12	64	4, 7, 8	36	2
Longreach	29·91	100	71	107	16	62	2, 3, 4, 8	11	3
Mitchell	29·90	94	63	106	19	49	9	119	6
Western.									
Burketown	..	96	73	104	10, 22	67	3, 5	2	2
Boulia	29·83	100	71	109	12	61	8	4	1
Thargomindah	29·88	97	69	110	18, 19	56	9	18	1

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